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RAILWAY LOCOMOTIVES AND CARS

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... OFFICERS AND SUPERVISORS RESPONSIBLE FOR DESIGN, CONSTRUCTION AND MAINTENANCE OF MOTIVE POWER AND ROLLING STOCK

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...ectrical Engineer

...e-Lounge Cars
...he Milwaukee

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...hern Pacific
...Brake Shop

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BUFFALO BRAKE BEAM CO. **NEW YORK**

FEBRUARY, 1953

VOLUME 127

No. 2

RAILWAY LOCOMOTIVES AND CARS

Founded in 1832 as the American Rail-Road Journal.

Simmons-Boardman Publishing Corporation: James G. Lyne, President, New York; Samuel O. Dunn, Chairman Emeritus, Chicago; J. S. Crane, Vice-Pres. and Sec., New York; C. Miles Burpee, Vice-Pres., New York; John S. Vreeland, Vice-Pres., New York; H. H. Melville, Vice-Pres., Cleveland; C. W. Merriken, Vice-Pres., New York; John R. Thompson, Vice-Pres., Chicago; Wm. H. Schmidt, Jr., Vice-Pres., Chicago; Fred W. Smith, Vice-Pres., Chicago; Robert G. Lewis, Asst. to Pres., New York; Arthur J. McGinnis, Treasurer, New York; Ralph E. Westerman, Asst. Treas., Chicago.

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Published monthly by Simmons-Boardman Publishing Corporation at 1309 Noble St., Philadelphia, Pa. Entered as second-class matter, January 16, 1953, at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscriptions payable in advance. Postage free. U. S., U. S. Possessions and Canada: *Railroad employees*—One year $2, Two years $3. *Other than railroad*—One year $4, Two years $7. Other countries in Western Hemisphere: One year $5, Two years $10. All other countries: One year $7, Two years $14. Single copies 50 cents. Address Robert G. Lewis, Asst. to Pres., 30 Church Street, New York 7.

Editorial and Executive Offices: 30 Church street, New York 7, and 79 W. Monroe street, Chicago 3. Branch offices: Terminal Tower, Cleveland 13; 1081 National Press bldg., Washington 4, D.C.; Terminal Sales bldg., Portland 5, Ore.; 1127 Wilshire blvd., Los Angeles 17, Cal.; 244 California St., San Francisco, Cal.; 2909 Maple avenue, Dallas 4, Tex.

Railway Locomotives and Cars is a member of the Associated Business Papers (A.B.P.) and the Audit Bureau of Circulation (A.B.C.) and is indexed by the Industrial Arts Index and also by the Engineering Index Service. Printed in U. S. A.

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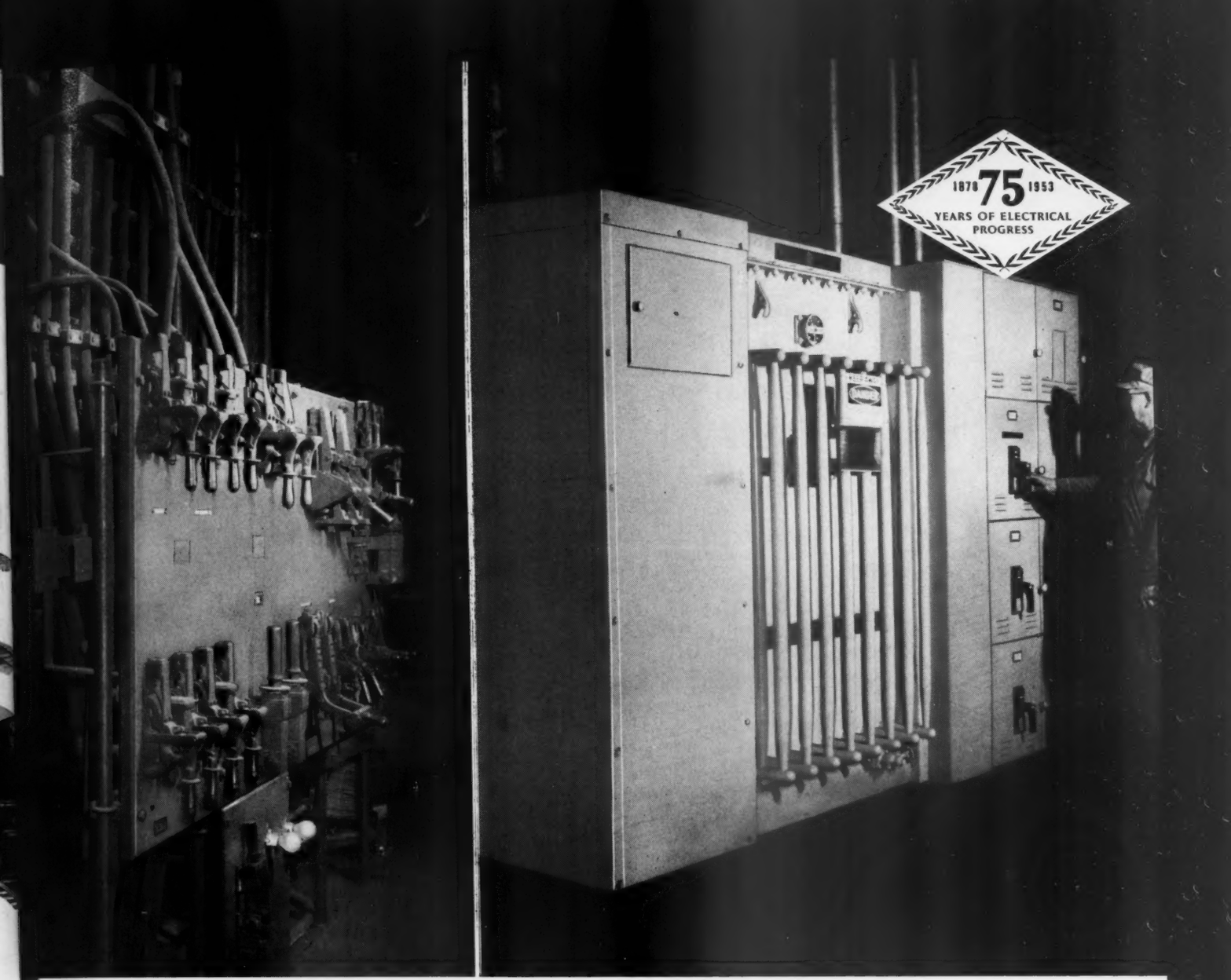
Freight Car Bearing Performance on 5 Class I Railroads Jan. - June, 1952

ROAD	CAR MILES	CAR MILES PER HOT BOX
A	671,393,660	805,028
B	841,889,615	583,430
C	342,236,133	1,306,244
D	608,257,451	677,347
E	79,531,783	548,495
Total	2,543,308,642	710.025

Here are the records for five top railroads in bearing performance. These records can be equalled or bettered by other roads.



Obsolete switchboard equipment and open framework have been replaced by modern metal-enclosed G-E load-center unit substations.

ickel Plate Road Speeds Modernization With Compact G-E Unit Substations

Nickel Plate Road, Brewster, Ohio—two compact G-E -KVA load-center unit substations are helping the kel Plate modernize its locomotive repair shop here. Nickel Plate replaced its old open-type switch- rd with compact G-E unit substations located near center of the load. These new substations saved able floor space for the Nickel Plate and eliminated ly 3 tons of low-voltage cable.

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By installing G-E unit substations in your operations, you too can gain important savings by minimizing voltage spreads throughout your shop, and reducing motor heating, lamp burnouts, and speed variations in your machine tools.

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GENERAL ELECTRIC

When Is "Old Age?"

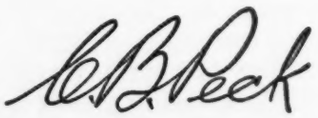
The Manpower Division of the Defense Transport Administration has just issued D.T.A. Special Manpower Study No. 9 entitled "The Older Workers and the D.T.A. Industries." The objective is to interest the industries within its bailiwick in looking to men ready for retirement or already retired under formal pension and retirement plans as a source of much needed manpower during the defense emergency. It is worthy of thoughtful consideration by everyone who shares the immediate responsibility for maintaining adequate personnel, and particularly by those who are in a position to exercise influence on personnel policy.

There are two aspects of the question of policy with respect to the age limits of employment which go beyond its consideration in relation to the emergency. First is the increasing percentage of older persons in our population. Fifty years ago the average life span was 47 years. Today, it has increased to 67 years and the number of persons 65 years of age or older has quadrupled during the half century. In another ten years further advances in longevity will have been achieved.

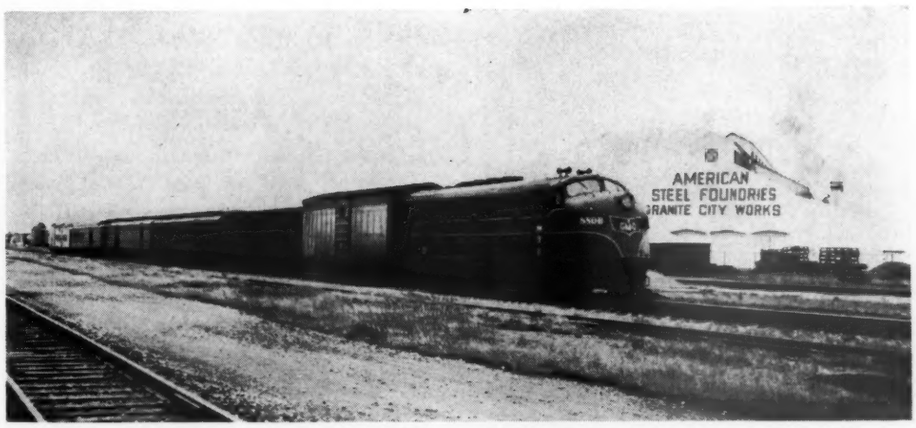
This creates a problem which is both social and economic. Considered from the standpoint of those 65 years of age and older, it raises the question of why they should be turned loose with nothing productive to do while still strong and in good health. From a sociological point of view, this situation might be remedied by a program of preparation for retirement which would make the development of some avocation, on which one could fall back for a center of interest after retirement, a part of the education for living. This, however, overlooks the economic aspect of the situation. Just how large a proportion of the population can those doing the productive work of society afford to carry? The trend of longevity is going to increase the proportion of retired workers. If this gets beyond the practicable limit which the working population can afford to support in idleness then there is no answer to the problem but to revise our prevailing ideas as to retirement so that they are in keeping with the reality of old age now and in the future.

This brings up the second aspect of the problem. In the case of rank-and-file employees, it leans to questions pertaining to modifications of pension systems and perhaps changes in job classifications for the older workers. In the case of promoted employees in the various levels of supervisory positions on up to executives, there is the question of what may be lost by the delay in promotions resulting from retaining men beyond present retirement ages.

Complete answers to these questions are not immediately apparent. But the need for additional personnel which is being created by the defense emergency is bringing to light the fact that many workers of all categories who have reached the age of retirement, compulsory in many cases, are not yet old so far as their capacity to produce is concerned and are available to meet the deficiencies in the current supply of workers within the age limits usually considered employable. The experience gained during the emergency, it is hoped, may give impetus to serious consideration of the longer-range problem.



What Causes Stresses in Brake Beams



Two A.S.F. service laboratory cars were attached to a GM&O local train for 54 test runs totaling over 5,000 miles.

Description of both laboratory and road tests conducted for the purpose of developing a one-piece freight-car brake beam.

A NUMBER of interesting facts were learned about what causes stress in brake beams from a series of laboratory and road tests conducted in conjunction with the development of the one-piece cast steel brake beam for freight cars. The tests were conducted by American Steel Foundries, and the results reported in a paper by R. B. Cottrell, chief mechanical engineer, at the December meeting of the American Society of Mechanical Engineers in New York.

Analysis of road test data, gathered from attaching two A.S.F. Service Laboratory Cars to a local GM&O train making frequent stops, showed the effect on brake beam stresses from such things as speed, brake applications, wheel rotation, position of beam and car weight.

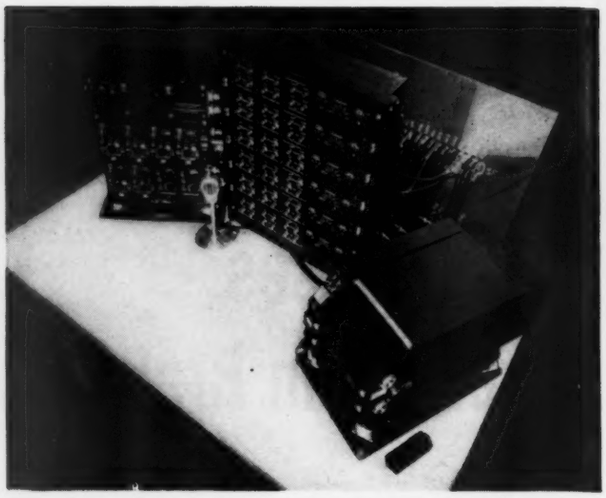
What the Tests Showed

Speed has little, if any, effect on brake beam stresses. A survey of traces of SR-4 strain gage readings taken at speeds of 20 through 80 m.p.h. indicated that speed had no appreciable effect on brake beam stresses. This was so evident that the bulk of the analysis was carried out independently of speed.

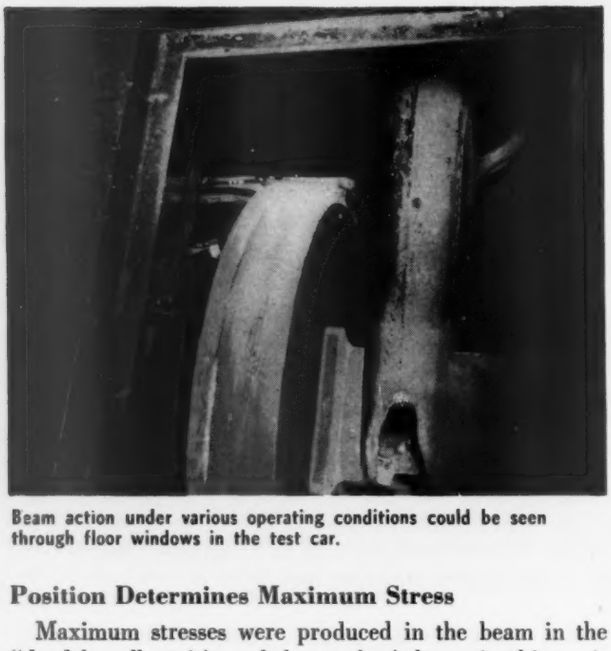
Studies of vibration frequencies in non-loaded beams showed no serious vibration frequencies in the beams unless a braking load was applied to them. With the car running free, and no brake application, the vibration pattern was minor regardless of speed. As expected, the recordings showed that the highest stresses in the brake beams occurred during brake applications. While not strictly linear, the amount of stress was generally proportionate to the brake cylinder pressure. Such stresses, of course, were augmented in certain instances due to impacts which occurred at road crossings, rail joints, crossovers, and other track irregularities.

Wheel rotation has an appreciable effect on beam stresses. The forces on the beam due to friction between the brake shoe and the revolving wheel results in an augment. This augment may be additive or subtractive, depending upon the location of the beams in the trucks and the direction of rotation.

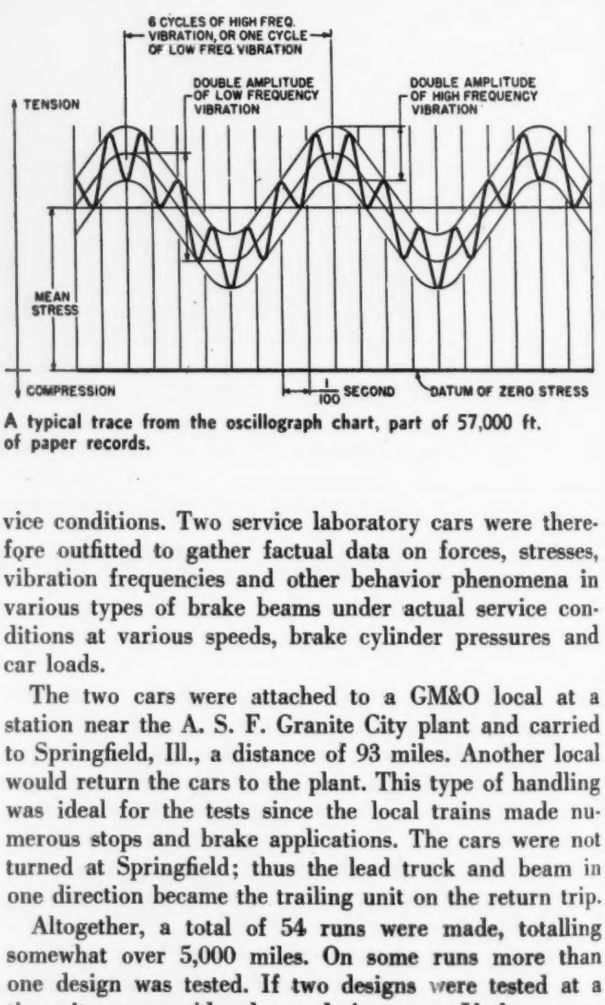
One of the laboratory cars on which six basic brake beam designs were tested, including both unit and hanger type.



The oscillograph set-up had an 18-channel bridge switch by which three different groups of six gages each could be used.



Beam action under various operating conditions could be seen through floor windows in the test car.


6 CYCLES OF HIGH FREQ. VIBRATION, OR ONE CYCLE OF LOW FREQ. VIBRATION
DOUBLE AMPLITUDE OF LOW FREQUENCY VIBRATION
DOUBLE AMPLITUDE OF HIGH FREQUENCY VIBRATION
TENSION
MEAN STRESS
COMPRESSION
1/100 SECOND
DATUM OF ZERO STRESS

A typical trace from the oscillograph chart, part of 57,000 ft. of paper records.

Position Determines Maximum Stress

Maximum stresses were produced in the beam in the "dead lever" position of the truck. A beam in this position consistently showed not only the highest stress, but also higher overall stresses than those in the other or "live lever" location.

As expected, the design of the structure had an effect on stresses and stress pattern. It was noted that the general overall picture was similar to that of the modern truck side frame, but varied somewhat between designs.

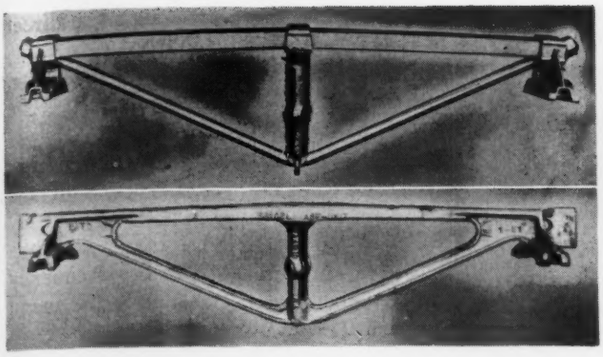
In general, higher average stress patterns were noted under loaded car conditions than under light car conditions. This, of course, is obvious inasmuch as for proper train control, heavier cars require heavier brake applications to stop a train within desirable stopping distances.

The study from which these conclusions were drawn was prompted several years ago when A. S. F. began to feel that the then standard fabricated brake beam of 15,000-lb. capacity was no longer suitable for modern freight service, particularly from the standpoint of maintenance.

Initial development work of the cast steel brake beam was based on laboratory tests. These were, however, supplemented by extensive road tests on the theory that promising performance in the lab is only an admission ticket for further performance testing under actual service conditions. Two service laboratory cars were therefore outfitted to gather factual data on forces, stresses, vibration frequencies and other behavior phenomena in various types of brake beams under actual service conditions at various speeds, brake cylinder pressures and car loads.

The two cars were attached to a GM&O local at a station near the A. S. F. Granite City plant and carried to Springfield, Ill., a distance of 93 miles. Another local would return the cars to the plant. This type of handling was ideal for the tests since the local trains made numerous stops and brake applications. The cars were not turned at Springfield; thus the lead truck and beam in one direction became the trailing unit on the return trip.

Altogether, a total of 54 runs were made, totalling somewhat over 5,000 miles. On some runs more than one design was tested. If two designs were tested at a time, it was considered two design runs. If three were tested, it was designated three design runs. On this basis, 156 design-runs were made during which 57,600 ft. of oscillograms were taken. Many other pertinent records were obtained as well as much visual information on beam action under various operating conditions. Altogether six basic brake beam designs (four cast steel and two fabricated construction)—both unit and hanger-type were used in these 1951 tests.



The old and the new. The lower picture shows the one-piece cast-steel beam.

Equipment for the Test

The regular instrumentation of the two service laboratory cars was supplemented by electric strain gages and oscillograph equipment. The brake beams under investigation were applied to A. S. F. Ride Control trucks with 2½-in. spring travel. The car equipped with these trucks has a weight at the rail of 60,000 lb. which could be adjusted to a maximum of 169,000 lb. This car is fitted with heavy glass plates in the floor over the wheels from which the action of the beams could be witnessed.

Type SR-4-Electric strain gages were applied to the test beams at thirty-six locations which were chosen, from a study of static and dynamic strain gage tests, to give representative results of strain and vibration. In the first part of the test program a thorough exploration of the beam was made under many different operating conditions. Later on it was possible to reduce the number of readings substantially and still obtain sufficient and adequate records of design and operating behavior.

The strain gages were carefully covered with wax, then wrapped with soft cloth and securely taped, the shield leads from the gages being fastened to the beams and gathered together and cabled. The cabled leads were then secured to the underside of the car body to eliminate any possibility of fouling on any of the truck parts or brake rigging with the leads being carried up through the floor to oscillograph and auxiliary equipment.

The oscillograph setup had an 18-channel bridge switch which provided six simultaneous strain and vibration records on a 7-in. oscillograph chart. By means of the 18-channel bridge switch, three different groups of six gages each could be used at will during a test run. Prior to the start of each test run, a calibration record was obtained for the 18 gages selected, with calibrating resistors available in the bridge switch. These provided for bridge unbalance simulating, five steps, a stress range up to 80,000 p.s.i. Overall response of the system is uniform from 0 to 500 cycles per second within plus or minus 2 per cent.

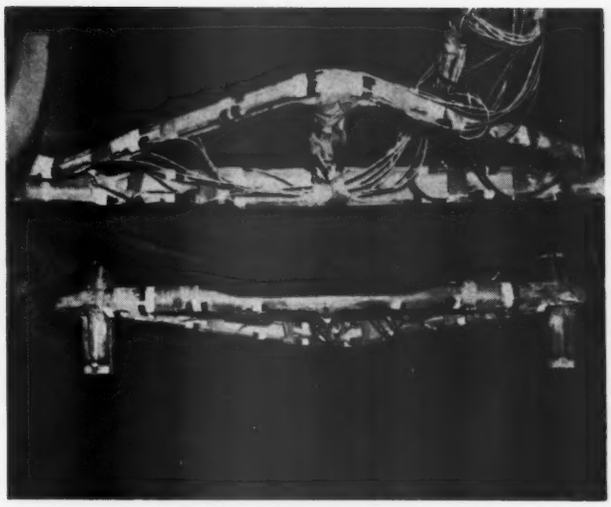
Chart speed in the recorder was variable over a wide range and for these tests a speed of 28.8 inches per second provided adequate speed for frequency analysis. Each chart roll contained one hundred feet on which ten recordings of approximately five seconds duration each could usually be obtained.

Analyzing the Oscillograph Records

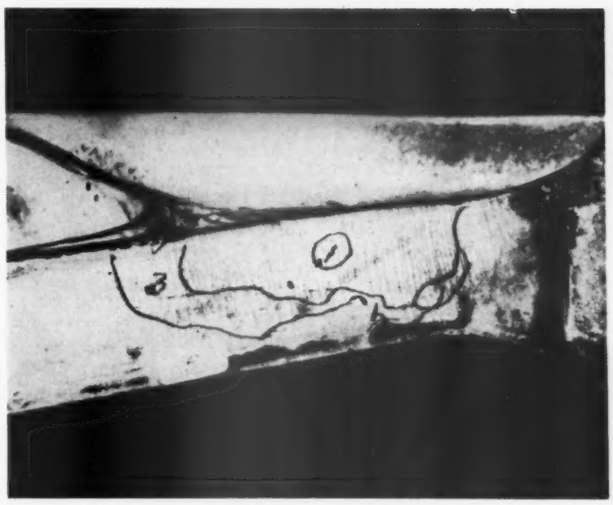
In many vibration problems, the vibration consists of a pattern which is periodically repeated with great regularity. Such phenomena can be represented by a Fourier series of sinusoidal terms, and a number of practical schemes have been devised to accomplish this. However, the vibration present in the unsprung portion of a freight car truck is seldom regular, but varies continually and may never repeat exactly. Therefore, any method of analysis which assumes a constant and regular vibration can be only an approximation at best. Accordingly, it was considered most practical to use approximate methods which would allow a large number of records to be analyzed in a reasonable length of time.

From an engineering standpoint, the most important consideration is the maximum stress to be expected under operating conditions. It is also important to have information on the ratio of the maximum dynamic stress to the nominal static stress, and the peak-to-peak range and frequencies of any vibration present.

If the wave form of the vibration is not too complex, the desired information may be readily determined by visual examination and direct measurement of the trace on the paper record. If the vibration is quite complex, an accurate analysis will be impossible, because of the failure of the phenomena to repeat exactly. However, the peak



Type SR-4 electric strain gages were applied to the test beams at 36 locations to obtain operating data.



Among the lab tests was the application of Stresscoat, a brittle lacquer which cracks at various stress ranges.

stress values and the approximate ratio of dynamic to static stress components can be estimated with satisfactory accuracy.

The records were analyzed by the "Envelope Metthod" described in detail in the book "Waveform Analysis" by R. G. Manley. By sketching the envelope of the highest frequency component, the highest frequency can be visually separated from the lower components. The frequencies of the predominant vibrations are estimated by counting peaks, keeping in mind the probability of some of the peaks being masked by the irregular nature of the traces. Timing marks spaced each .01 secs. enables accurate frequency measurements to be made.

All records obtained during braking contained a direct stress or "zero frequency" component of considerable magnitude as compared with the vibratory components. The value of the direct stress was estimated as the mean value of the trace by a visual examination.

In analyzing the oscillograms, the envelope of the high frequency vibration is sketched in. The height of the envelope is the double amplitude of the high frequency vibration, and the variation of the centerline of the envelope is the double amplitude of the low frequency vibration. The mean value of the envelope is the mean stress value. Numerical values must be obtained, of course, by static calibration of the equipment.

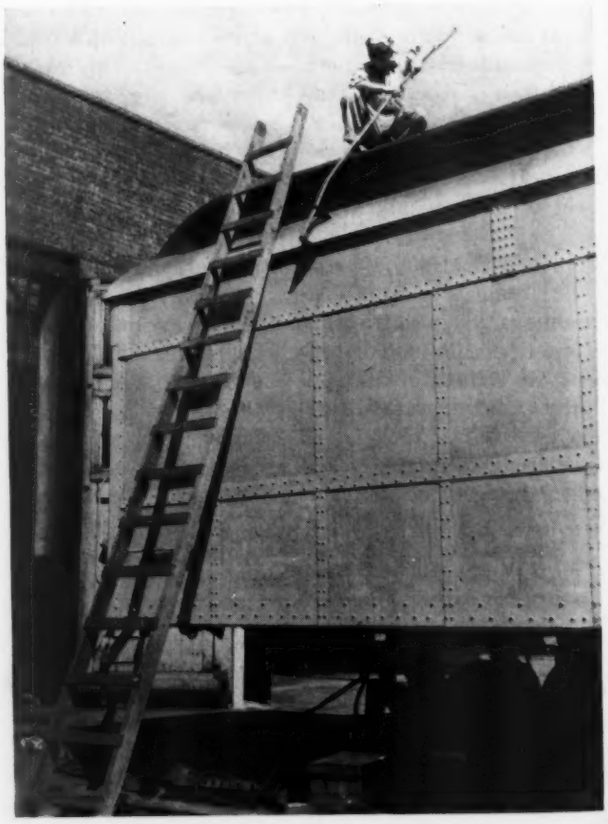
Car Roof Patch Puller

Pressing roof sheets in place for securing is easy with a puller developed at the Missouri Pacific shops in Little Rock, Ark. The puller is 6 ft. long made of ¾-in. pipe with a hook at one extreme end to serve as a fulcrum, and a pressure foot which can be secured in place with a set screw anywhere along the length of the puller.

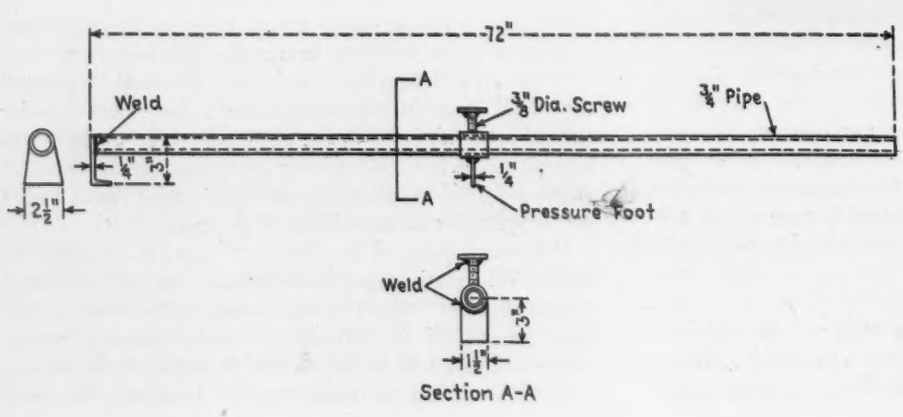
Before the puller was developed, roof sheet patches were screwed down. This had two disadvantages: First, the metal tended to buckle; second, the holes made for screwing the patches down had to be welded up before outshopping the car.

The present method of forcing the roof sheets into proper position and shape is suitable for either clerestory or oval roofs, and can be used as well for patches around door openings and windows, or for upper deck patches.

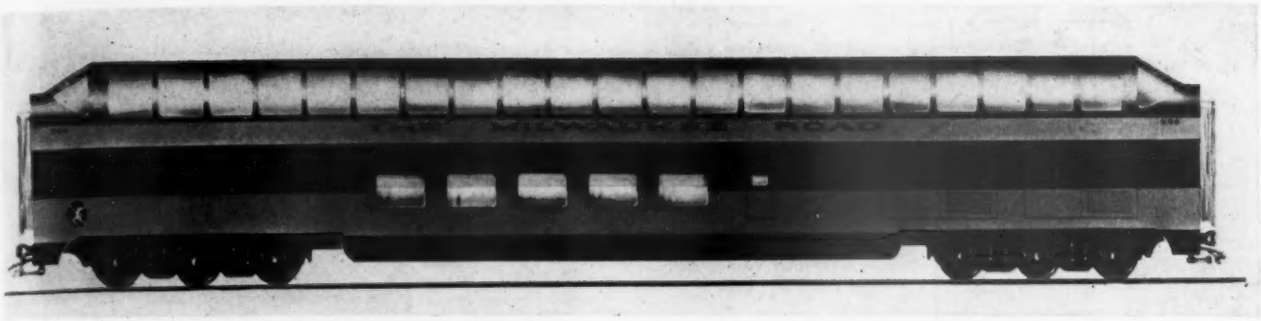
To secure roof patches in place, the end hook fits under the drip moulding. The pressure foot is slipped along the length of the pipe to the point where it is desired to apply the pressure, and the foot secured at this location by tightening the ⅜-in. set screw. Pressing down on the free end of the puller every foot or so along the length of the patch forces it firmly into place. Tack welding secures it.



One man can easily force roof patches into position with this puller. — Tack welding secures the patches in place.



Details of the puller for tightening down roof sheet patches, upper deck patches, door and window opening patches.



Dome-Lounge Cars for the Milwaukee

Ten cars, built by Pullman-Standard and placed in service on the Hiawathas, are first full-length cars of their type.

On the first of last month the Milwaukee road added ten new "Super Dome" cars to its Hiawatha trains which were built by the Pullman-Standard Car Manufacturing Company. One will be assigned to each of the six "Olympian Hiawatha" train sets in daily Chicago-Tacoma-Seattle service and one to each of the four daytime "Hiawatha" trains in Chicago-Twin Cities service. All of the cars will be placed next to diners; they will not displace the "Sky Top" lounge car for first-class passengers carried at the rear of each of these trains.

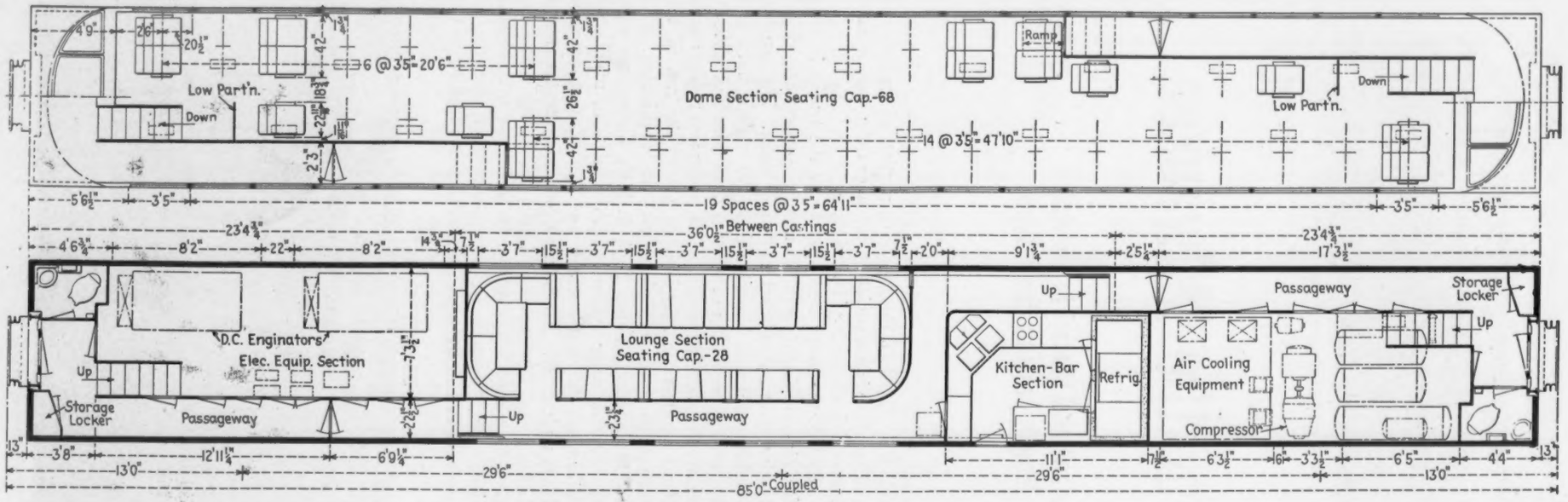
The new "Super Dome" car was designed by the Pullman-Standard passenger-car engineering division, working in conjunction with officers of the railroad. The air-conditioned full-length dome section accommodates 68 passengers in rubber-cushioned seats generously spaced 3 ft. 5 in. on centers and made non-revolving, as the car is reversed at the end of each run. Beneath the dome is a dining and lounge section, seating 28, where beverages and light snacks are served from an all-electric stainless-steel kitchen.

Loudspeakers carry radio programs and announcements over the train public-address system. RCA equipment is utilized including a plate-type radio antenna which is placed on the depressed portion of the forward roof as there is not sufficient clearance for a conventional antenna above the roof center line.

Part of the lower level space over the trucks is used for air-conditioning equipment, air compressors, diesel Enginator units, and fuel and water tanks. The housing of this equipment is designed so the various units can be serviced regardless of weather conditions and whether or not the train is moving. This equipment renders each dome car mechanically independent of the rest of the train as to power for lighting and air conditioning.

The full-length dome, 15½ ft. high, harmonizes with the exterior color scheme which consists of traditional Milwaukee "harvest" orange and "royal" maroon with black underbody. The interior decorative treatment and lighting also merit special description. In the dome section, floor covering is rubber tile with appropriate inlaid design in the aisle, an authentic Indian motif being incorporated in the aisle strip. Stairways leading to the

Details of the new design six-wheel truck.



Floor plan of new Milwaukee "Super-Dome" car—dome level (above) and lounge level (below).

The passageway (left) alongside the lounge, the dome section (center), and the stairway (right) from the dome.

PRINCIPAL DIMENSIONS AND WEIGHTS OF MILWAUKEE DOME CARS

Length over platform, coupled, ft.	85
Length between truck centers, ft.	59
Width over side sills, Ft.	10
Width, inside between posts, ft.-in.	9—6
Height, rail to top of roof (dome), ft.-in.	15—6
Height, rail to top of roof (conventional), ft.-in.	13—6
Height, rail to top of floor, ft.-in.	4—3
Height, rail to top of low floor, in.	23
Height, rail to top of dome floor, ft.-in.	8—8
Truck wheel base, ft.	11
Wheel, diameter, in.	36½
Journal size, in.	6½ by 12
Scale weights, lb.:	
Car body	134,050
Trucks (two)	66,550
Lading	9,080
Passengers	14,400
Ready to run	224,080
Lading weight details, lb.:	
Fuel oil	2,250
AC Condenser water	1,586
Air-pressure water	2,829
Lockers and refrigerators	2,065
Crew	350
Total	9,080
Passengers weight details, lb.:	
68 seats in dome	10,200
28 seats in lounge	4,200
Total	14,400

upper dome are covered with carpeting, featuring a broken-line pattern to match rubber flooring with which it comes in contact. Stairway railings are alumilited aluminum tubing with a modesty shield below the railing.

Copper-color dome-seat covering is supplied by Goodall in a pattern which also shows Indian influence and forms "M" for Milwaukee in a running design. Arm rests are covered with the same material and seat ends with Buffalo grain turquoise color, stain-proof Avtrim.

The dome ceiling is painted sky blue. The remainder of the dome section, including retainer frames for the curved glass windows and the dash at front and rear, are painted sun tan. At either end of the car on the dash is an edge-lighted Lucite plaque, representing the running Indian, the Milwaukee trademark. Window cappings are laminated Formica with pearlescent finish.

Overhead lighting is Luminator incandescent type of a modern glass-block design in groups of three blocks to a fixture. The fixtures are in a staggered arrangement, avoiding a continuous effect. Some of the dome seats are equipped with aisle lights for visibility.

All dome seats, made by Heywood-Wakefield, are equipped with ash receptacles and adjustable foot rests. They are not only non-reversing but have fixed backs as it is not anticipated that many passengers will want to sleep in this car.

There are 21 rubber-mounted double-glazed curved sash, 3 ft. wide by 5 ft. high, in each car side. They are made by Adams & Westlake of ¼-in. Solex heat-resistant plate glass on the outside and ⅜-in. laminated Solex safety plate glass on the inside. In fact all glass, both utilitarian and decorative, in this car is safety glass as a precaution against personal injury.

Lower Level Arrangement

The lower-level lounge section with seating capacity of 28 is accessible from passageways laid out in staggered arrangement from either end of the car. The entire lounge room, including passageways leading to double-acting swing doors, is covered with Wilton-type carpeting, original in design and based on an Indian motif with green and antique gold coloring.

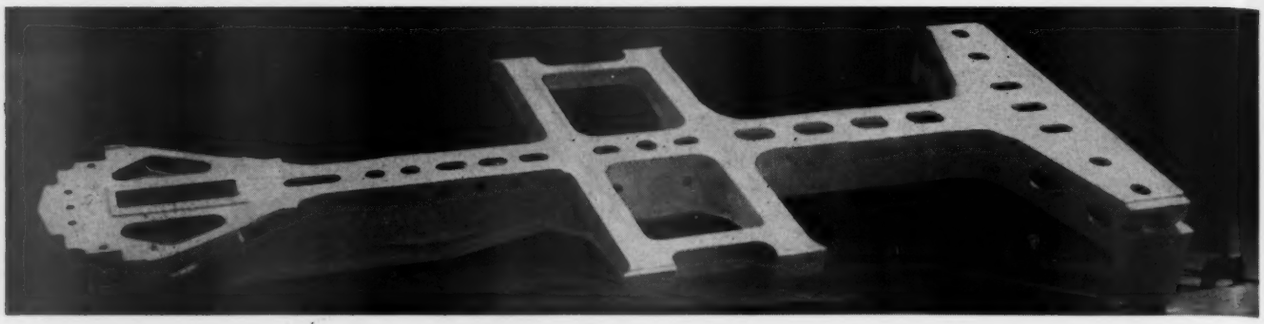
Workmen applying the window frames in the dome section.

The lounge section in the depressed center of the car.

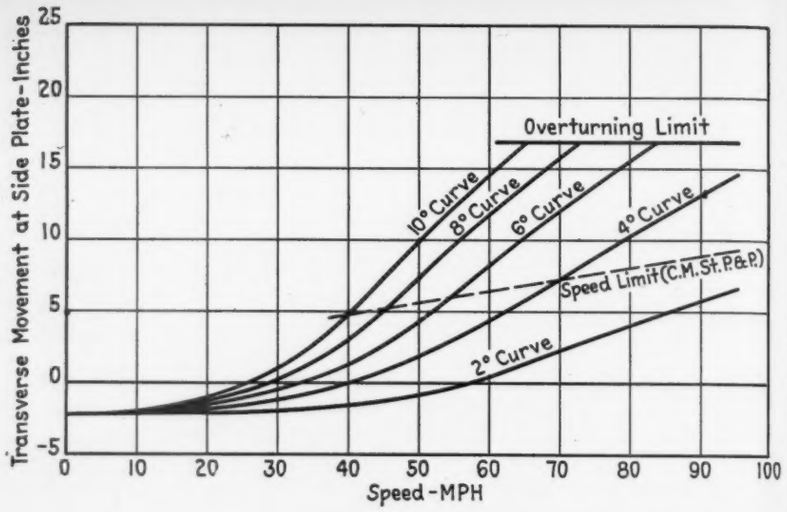
All furniture in this level is covered in Ashtabula top-grain leather in gold or green antique finish. Tables are covered with blisterproof realwood Formica. Table pedestals have a chrome satin finish and the bases of built-in furniture are made of stainless steel.

Walls of this entire area are painted surf green. The ceiling and the suspended ducts which house the air-conditioning and the continuous Luminator incandescent lighting are painted a sun tan. The Ajax venetian blinds and tapes are citron yellow, the operating part of the blinds having a satin finish.

Large pier panels in the room (eight in all) have safety golden plate glass mirrors with wheelcut designs of a thunder bird. The vertical pylons which form part of the passageways are of stainless steel with safety glass panels in an appropriate Indian motif, wheelcut design. Horizontal safety-glass panels form part of the passage-

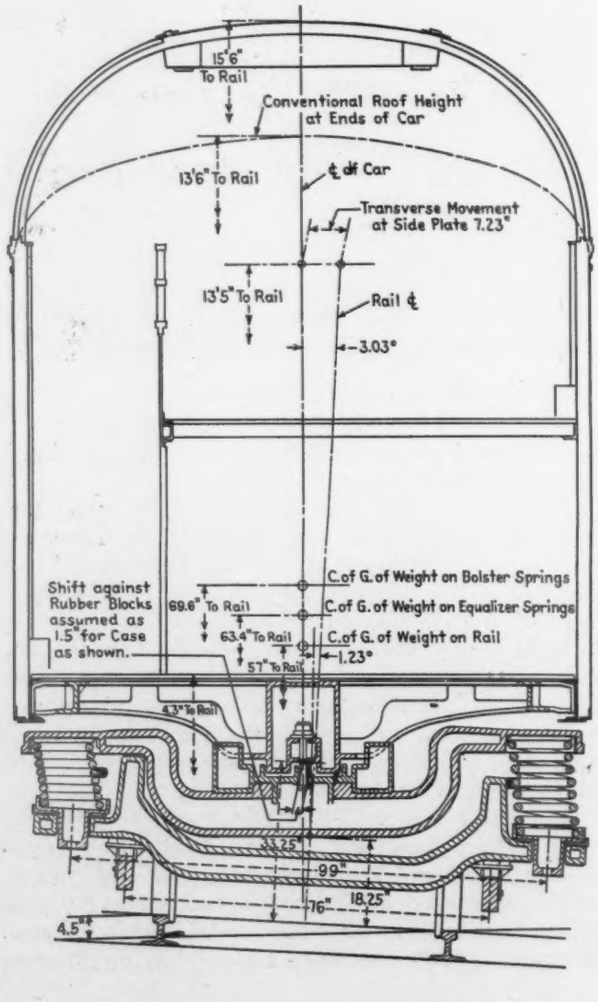


The car underframe includes at each end one of these Commonwealth one-piece cast steel platforms.



Body roll of full-length dome car, calculated for curves with 4½-in. super-elevation.

Body-roll diagram for full-length dome car. Condition shown is for 70 m.p.h. on 4-deg. curve with 4½-in. super-elevation and full passenger load.



way partition and are also made of an imitation sandblast wheelcut design with appropriate Indian motif.

The glass mirrors are encased in extruded aluminum frames. Window cappings are processed Vicwood Formica in a blond wood effect to match the realwood prima vera Formica table tops. All heater pipe grills are stainless steel.

The partition at the rear end of the room is a lighted pictorial mural in full color, furnished and installed by Kaufman & Fabry, Chicago. This mural, with special Luminator lighting, has the appearance of a picture window frame without glass, the frame being painted the surf wall color.

At the forward end of the room is a stainless-steel kitchen-bar section with service opening, this section being of Pullman-Standard design and construction. The portion of wall adjacent to the opening is ornamented with a copper metal repousse in old form, again showing the running Indian Milwaukee trademark.

The car body is really constructed on three levels—the normal entrance floor height 4 ft. 3 in. above rail, the depressed lounge-floor level 23 in. above rail, and the dome section floor level, 8 ft. 8 in. above rail. To carry static and dynamic load stresses satisfactorily through a structure of this kind presented many interesting structural problems. Each girder-type side is a structural section terminating at the side plate. Most important structural members are continuous the entire length of the car, including side plates, window headers, belt rails and side sills except portions at the lounge floor. In the usual construction, part of the roof also constitutes an effective section. Deflection had to be held to a minimum to protect the car-length expanse of glass in the dome.

Extra strength is provided in the carlines between windows to tie the sides together. At the center of the car above the dome aisle lies a longitudinal panel of roof sheet about 2 ft. 4 in. wide, extending between box-section purlines, which give necessary rigidity to the roof structure.

The steel platform underframe casting at each end, made by General Steel Castings Corporation, is used to distribute buffing and other loads to side sills of generous section which extend around the depressed center portion of the car.

Each of these underframe end castings is 24 ft. 1¾ in. long, weighs 8,850 lb.

Few passenger cars, if any, in regular rail service have had a self-contained power plant of either the capacity or flexibility provided in the Milwaukee "Super-Dome" car. To take care of the maximum electric lighting, cooking and air-cooling load, two Waukesha diesel Enginator units of 25-kw. rated output each at 40 volts d.c. are mounted longitudinally in an equipment compartment at normal floor height over one of the trucks.

Each of the two Waukesha diesel engines, rated at 60 hp., is of the six-cylinder liquid-cooled type with direct fluid-drive connection to a fully enclosed electric generator. The generator regulators are set at 38 volts and the lamp regulators at 31 volts. Five Exide six-volt automotive-type batteries with 120-amp. capacity at 20 min. rating are floated across the line and supply power for engine starting. Two diesel fuel tanks of 150-gal. capacity each are installed.

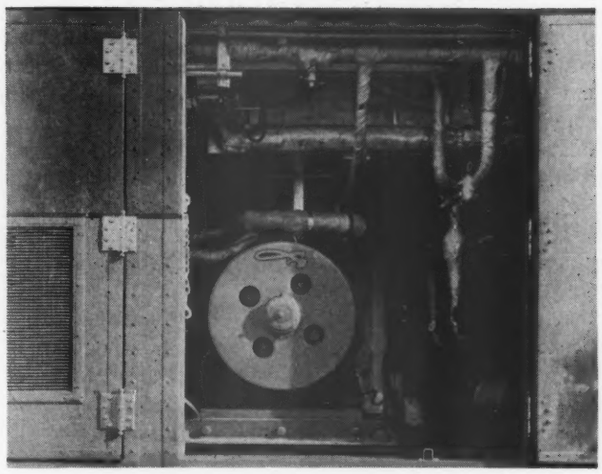
The Milwaukee "Super-Dome" car is cooled by a Trane air-conditioning system with double the capacity of most present-day passenger-car installations. Each of the new dome cars has refrigeration equipment capable of producing 20 tons of ice a day, which compares with 7 to 8 tons of cooling capacity for standard sleepers and coaches.

Two developments by the Trane Company are the eight-cylinder, 20-ton compressor and the Trane combination dry-wet condenser, which cools and condenses the hot, gaseous refrigerant from the compressor, and thus dissipates heat from the car to the outside air. Under moderately warm conditions, the condenser operates dry, much the same as the condenser on a household refrigerator.

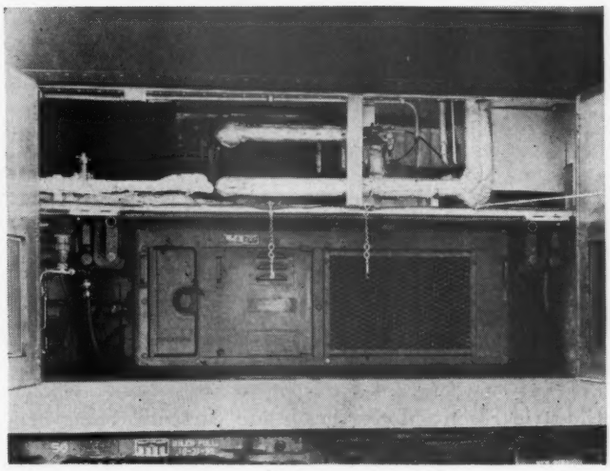
During 90-deg. summer-weather, the condenser coils are sprayed automatically with water, which intensifies the cooling as it evaporates. Because the new condensers operate "dry" about 90 per cent of the time, they are said to use a fraction of the water consumed by fully flooded condensers, this water saving being highly important on hot, dry western runs.

Three standard Trane railway air conditioners, which include steam heating coils, maintain controlled comfort conditions. Two eight-ton units supply filtered, conditioned air to the Pyle-National Multi-vent ceiling outlets in the dome section through double-glass windshield ducts at each end. A smaller four-ton air conditioner supplies the 28-seat dining-lounge section on the lower level, offsetting the heat and humidity of the electric kitchen. The air conditioners also maintain a slight positive pressure throughout the cars, thus minimizing infiltration of dust and moisture.

The heating system utilizes narrow unit-fin radiation



One equipment door closed and one open to show the Trane 20-ton compressor and connections.



One of two Waukesha 25-kw. Enginator units which can be pulled out of the equipment compartment.

with solenoid valve, latest-type loop equipment, zone-control and individual circuits for each portion of the car on the various floor levels, as developed by the Vapor Heating Corporation. By turning one switch on the electric control panel the trainman puts the system into operation; then sensitive Vapor thermostats take over and operate the steam valves and the air-conditioning compressor automatically as the outside temperature changes from subzero to over a hundred.

On mild days the car is heated by the overhead system, fresh air being brought into the car and mixed with recirculated air as it passes through a thermostatically controlled steam heated radiator in the duct leading to the overhead air duct in the dome and lounge section which distributes the heat evenly.

When it is cold, heat is also supplied by the floor unit-fin radiators. Heated air also moves up inside the wall and out openings in the window ledge, which adds materially to the comfort of passengers on outside seats.

One interesting feature of the heating system is the use of two Solar discs mounted outside on the car roof at the rear end. This device lowers the temperature setting of the thermostats in the dome to offset heat from the sun. When a cloud blocks out the sun the Solar Discs immediately react so that more heat or less cooling can

be provided in order to keep the car comfortable.

The fuel and water supply tanks and the equipment compartments also have thermostatically controlled heating systems. Hand-operated steam valves control steam supply to steam pipes around the fuel and water-filling inlets. Steam also heats water for the kitchen and wash rooms, controlled by a flow-limit valve in one of the Vapor safety steam regulators.

The six-wheel trucks with 6½-in. by 12-in. axles required to support the weight of the "Super-Dome" car are a special General Steel Castings design. The all-coil-spring truck is equipped with rubber bumpers, Miner bolster-locking center pin, Gatke center-plate liners, Fabreeka insulating pads under the equalizer ends and brake pins fitted with Pol-pin collars and cotters, supplied by the Elastic Stop Nut Company. Rubber pads to dampen vibration and noise are also applied at the constant-contact friction-type side bearings, bolster coil springs, bolster bumpers and anchor rods.

This truck differs from conventional six-wheel trucks in a number of ways, especially elimination of swing hangers and spring plank, with lateral movement transmitted through the bolster springs; provision of integral cross and center bolsters positioned above the truck frame and hence readily removable for easy truck inspection or repairs. Practically all truck parts such as springs, shock absorbers, anchor rods and rubber bumpers are located outside the truck frame. Even the side bearings are brought outside and spaced 8 ft. 3 in., as compared with 7 ft. 7 in. on standard passenger cars using six-wheel trucks to give added stability.

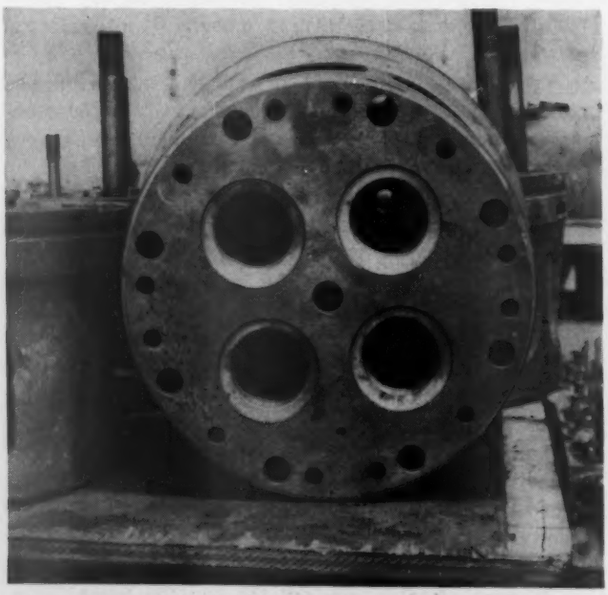
Truck springs are of the coil type, the four relatively stiff 9-in. diameter equalizer springs with 14⅜ in. free height and 2⅜ in. static deflection cushioning road shocks which would otherwise be transmitted to the main truck frame. To give a still softer and more flexible ride to the car body and contents, four 13⅝-in. diameter coil springs with 26-5/16 in. free height and 8-13/16 in. static deflection are installed between the main truck frame and the body bolster. The total vertical travel, limited by positive stops and cushioned by the Monroe shock absorbers, is 4 in., 1 in. above normal position and 3 in. below. The maximum lateral bolster movement is 2¼ in. each way from the center, cushioned for the first inch by the Houde absorbers and for the next 1¼ in. by the hydraulic device in combination with gradually increasing resistance of the rubber bumpers until a positive stop is reached.

Heads Converted to Grommet Type

Old-style Electro-Motive heads are currently being converted to the new grommet-type at the West Burlington shops of the Chicago, Burlington & Quincy. The water inlet holes are plugged with heli-arc welding after the base of the head has been sandblasted to clean it and after the old water holes have been chamfered to get good weld penetration. All the water inlet holes are plugged, the oval ones to change them to round holes, and the round holes because the spacings are different on the grommet-type heads.

The welding is done inside of an asbestos-lined cylinder slightly larger in diameter than the head and open at the top. During welding operations the top of the cylinder is covered by an asbestos lid with slots that permit the welder to get at the different sections of the head that are to be welded. The head is rotated by hand through a gear drive turned by the handle.

The secondhand liner which was used with each head undergoing conversion is saved as a replacement part.



Head converted to grommet type after the plugged holes have been drilled and the face ground.

Asbestos ring used in converting heads to the new grommet type. While welding, the ring is covered by an asbestos lid with suitable openings.

Two of the workbenches with conveniently spaced tool lockers.

Southern Pacific Air-Brake Shop

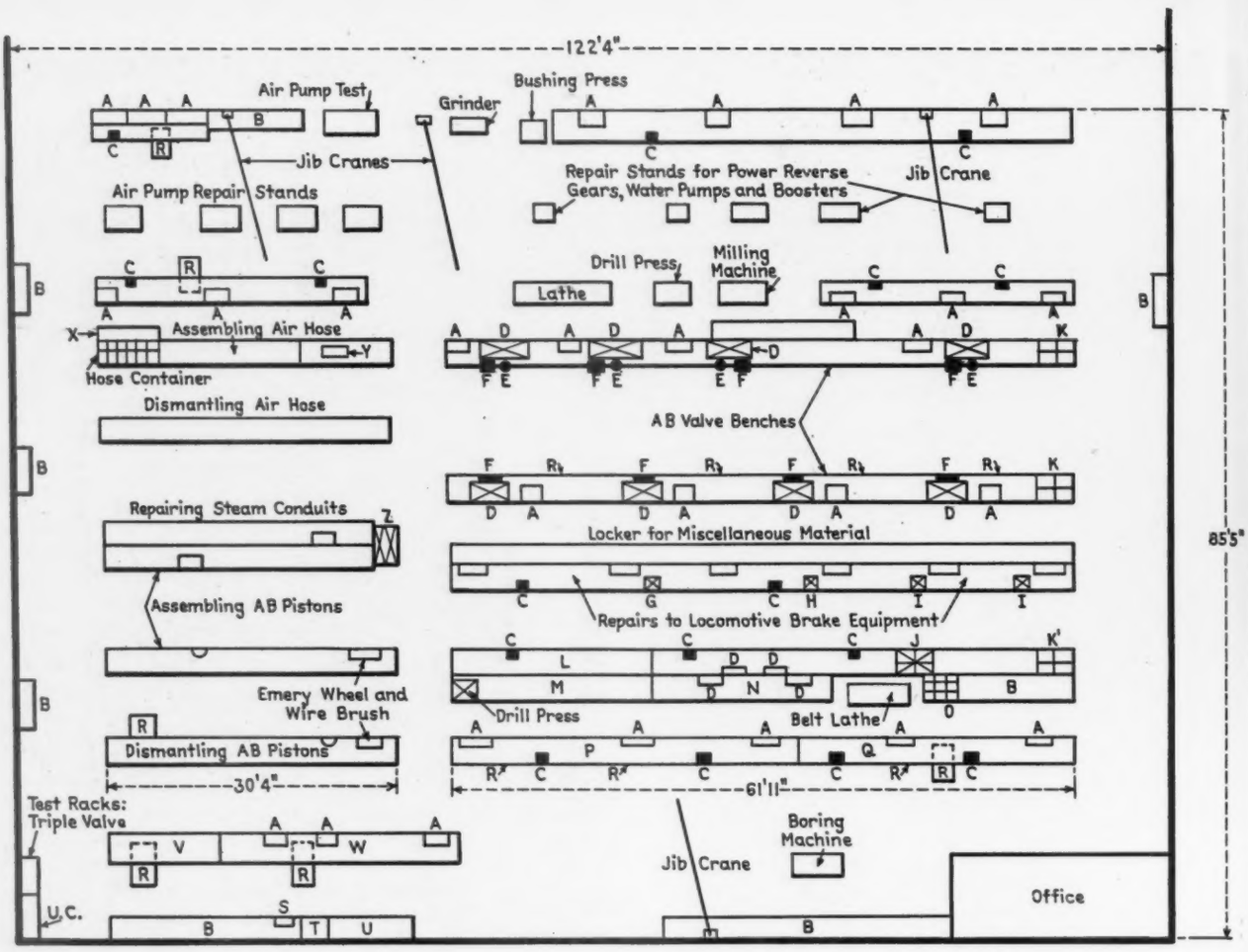
Facilities at Houston for handling air-brake equipment repairs take care of major overhaul work for passenger and freight cars as well as for locomotive equipment.

THE Southern Pacific has laid out a highly efficient arrangement in the back shop at Houston, Tex., for handling all types of repairs to air brake equipment. Major overhaul work is done here to all air brake equipment for diesel and steam locomotives and for freight and passenger cars used on the Southern Pacific lines in Texas and Louisiana (The Texas & New Orleans). With the new layout, and the new jigs and other equipment, AB valves can be disassembled, repaired and assembled in about half the time formerly required.

The layout of the air brake room and all principal items of shop equipment are shown in the accompanying keyed floor plan. The overall dimensions of the room are approximately 85 ft. by 122 ft., and it can be considered to be divided functionally into two parts.

The section on the left, or the west section, has nine benches approximately 30 ft. long, 3 ft. high and 3 ft. wide. The east section has seven benches averaging some 62 ft. in length and 3 ft. wide, with the top 3 ft. above the floor.

The west section is devoted primarily to repairing heavier items of air brake equipment with the exception



A—Tool lockers
B—Material lockers
C—Vises
D—Overhead tool racks
E—AB valve parts clamps
F—Power positioner for AB valves
G—Locomotive brake valve stand
H—Feed valve stand
I—Distributing valve stands
J—Test rack for diesel and steam locomotive brakes
K—AB test racks
L—Repair area for cut-out cocks and angle cocks
M—Air gage repair area
N—Repair area for welding torches, gages and regulators
O—Calibrating machine for diesel speed recorders
P—Area for repairing diesel equipment
Q—Globe valve repair area
R—Cleaning fluid drawer
S—Governor rack
T—HSC test rack
U—Test stand for diesel and passenger car electro-pneumatic equipment
V—Triple valve repair area
W—UC valve repair area
X—Water vat to test couplings
Y—Air hose testing
Z—Belt grinder to polish AB sleeves

Floor plan of the Houston air-brake shop and explanation of symbols.

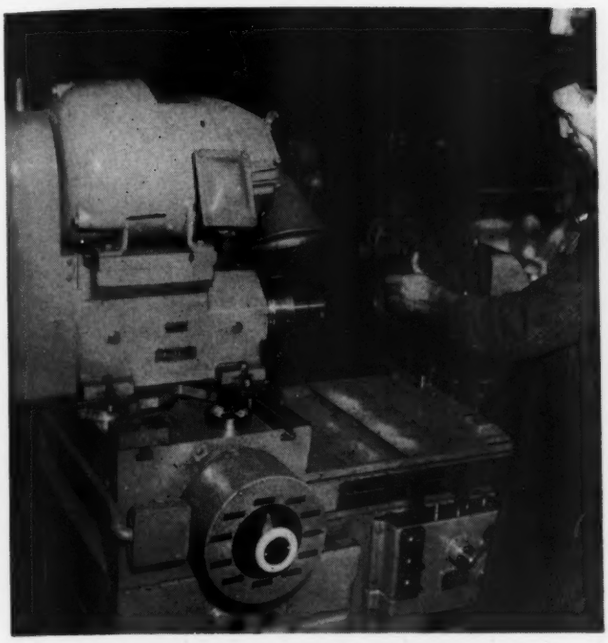
of a small area in the southwest corner. The latter has test racks for triple valves and U. C. equipment, a workbench for repairing the two equipments, and a workbench equipped with test stands (*T* and *U*) for diesel and passenger car electro-pneumatic equipment, and with a governor test rack, *S*. The remainder of the west section, going from south to north, is devoted to repairing and testing the non-pressure head pistons of A. B. equipment, steam conduits and air hoses. The northwest corner contains repair stands and a test rack for air pump work. The latter area is served by a 20-ft. jib crane with a 1-ton air hoist.

The northern quarter of the east section is also devoted to repairing heavier items of air brake equipment and other air-operated equipment. Beginning at the north end of the east section there is a grinder, a bushing press, and a workbench just over 50 ft. long. Below the bench are repair stands for power reverse gears, water pumps and boosters. Two jib cranes serve the area. The one on the left has a 20 ft. radius and a 1-ton air hoist, the one on the right a 15 ft. radius and a 3-ton air hoist. Below the repair stand are a 20-in. lathe, a drill press, and a small milling machine. To the right of the milling machine is a small work bench 30 ft. long for miscellaneous repairs to individual parts of the reverse gears, water pumps and boosters.

The lathe handles any miscellaneous machine work necessary. Among the jobs done are machining pistons for air pumps and for distributing valve pistons, the latter prior to sweating on a brass bushing which, after application, is machined to standard diameter on the lathe. In conjunction with the millling machine, shop made bushings are machined and milled for 8½-in. air compressure top heads.

Proceeding on south, the first two long workbenches are devoted to the repair of AB equipment. On both benches the unserviceable valve is delivered to the left, or west, end of the bench and is completely overhauled and tested as it goes to the east edge and AB test racks (*K*).

The next bench is devoted exclusively to locomotive brake equipment repairs, both diesel and steam. It is supplemented by the north half of the bench below it where cut-out cocks and angle cocks are worked on the left third, and miscellaneous work done on the right two-thirds. The equipment is tested on a diesel and steam locomotive air brake test rack near the right end (*J*), and on an AB test rack modified for handling locomotive equipment at the extreme right end (*K*). The south



Miscellaneous operations on angle and cut-out cocks, governors and various air-brake valves are handled on a precision boring machine.

strip of this latter bench handles air gage repairs (*M*) and repairs to welding torches, gages and regulators on the left (*N*). The right section of this area has a small belt lathe, a calibration machine (*O*) for diesel-electric speed recorders and a material locker for diesel air brake equipment.

The bench below this, and the southernmost full-length bench, is devoted to the repair and cleaning of diesel locomotive air brake equipment (*P*) and globe valve repairs (*Q*).

Below the bench is an Excello precision boring machine for grinding angle cocks, cut-out cocks, AB valves, diesel locomotive valves, U. C. valves, H6 and S6 valves, AD governors, and distributing valves.

To the right of the boring machine is the shop foreman's office and a locker for heavy materials, the latter served by a 15-ft. jib crane with a ½-ton air hoist.

Separate Cleaning Facilities

Cleaning of air-brake equipment is done in a small building to the east of the air-brake room where all air brake cleaning is done. Small air brake parts are placed in wagons and taken to the cleaning building where the parts are sprayed with mineral spirits to get the worst grease off. They are then rinsed off with a solution of locomotive cleaner and blown off with air, following which they are brought into the shops and delivered to the proper man and location for inspection and repair.

A final cleaning is given to each part before it is overhauled by the man doing the work. Each man has a drawer of mineral spirits which slides in under the bench out of the way for dipping the part for the final cleaning.

Both new and re-distilled mineral spirits are used for cleaning. Re-distilled spirits are used for the spraying in the cleaning building while the new mineral spirits are used exclusively in the drawers where the final cleaning is done.

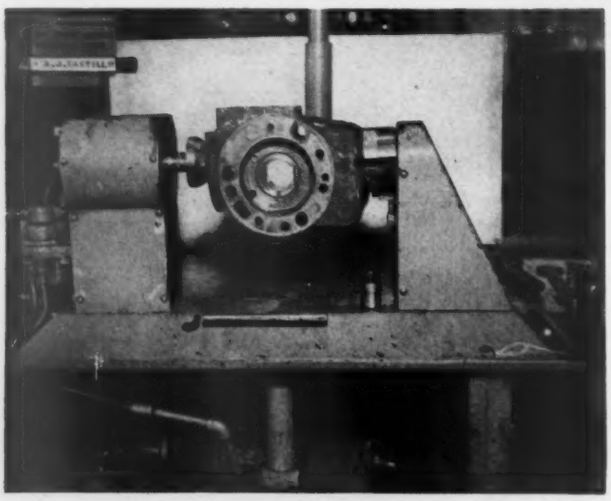
Dismantling an AB valve with an impact wrench from one of the eight overhead tool racks.

Remaining triple valve work is concentrated in this area along with certain car and locomotive electro-pneumatic brake work.

Air pumps are cleaned in a somewhat novel way. The pump is bolted to a bracket and connected to a steam supply through a Barco flexible joint. The pump and bracket are then submerged in a mixture containing equal parts of locomotive cleaner and caustic soda. Steam is admitted to the pump and the pump is run while submerged in the cleaner to cut the carbon out. While the pump is running submerged in the solution, the air connections are left open to work the cleaner through the air cylinder.

To rinse out the pump, the air cylinders are connected to the water main and the steam cylinders to the shop air line. Running the pump for a short while in this manner does a thorough rinsing job.

Part of the area for overhauling AB pistons. The sleeve polishing machine is in the right foreground.



Power positioner used to secure AB valves in any position convenient to the tools in the overhead rack.

Signs in each area aid appreciably in maintaining cleanliness in the shop.

Individual Features

The shop is liberally equipped with vises, clamps for various air brake valves, stands for overhauling locomotive brake valves, feed valves and other equipment which can be worked more efficiently with proper holding fixtures. There are a large number of small lockers for tools and material conveniently located throughout the air brake room rather than a few large storage areas for tools or materials. Thus everything necessary to complete a repair operation on a part is conveniently located near where the actual repair work is done.

Retractable hose reels supplying shop air are located at the air pump, the water pump and the booster repair stations. Similar reels are also located under the bench at all locations where parts have to be blown off with air. Individual moisture eliminators are used in conjunction with the air hose reels to supply dry air where AB and locomotive valves are blown off. These are located under the benches.

All benches and other repair and test areas are surrounded by a wooden floor rack for the workmen to stand upon. Each workman also has an individual 150-watt incandescent light for illumination of his own working area. Each test rack is illuminated by a fluorescent light located directly above the rack. Self-retracting hose reels supply the air to power tools which are used throughout the shop.

Each of the two benches for repairing AB valves is equipped with four overhead tool racks (*D*). On the north and south benches there are conventional type hand-operated clamps (*E*) for holding the AB valve parts for use in conjunction with the overhead tool racks; also on the north and south benches, air-operated power positioners (*F*) hold the complete AB valves. For dismantling and assembly.

Each of the eight overhead tool racks holds four portable tools on self-retracting hoses. This is accomplished by a spring loaded reel system for each tool which automatically lifts the tool out of the way when the workmen releases his grip. The four tools on each overhead rack comprise two impact wrenches, a wire brush and an air gun. Each rack is also fitted with a 150-watt incandescent lamp just in front of the upper framing to throw light directly on the work. This frame is about 3½ ft. deep by 5 ft. wide and is mounted about 4 ft. above the working surface of the bench.

The sleeves of the AB non-pressure head pistons are polished on a belt grinder (*Z*). The grinder is fitted with a large angle section against which the piston head is clamped snugly but not tightly. A small air cylinder pushes the sleeve against the belt of the grinder while the piston is revolved and moved axially by hand.

The small tool lockers which are located throughout the shop on the benches are 3 ft. 2 in. long and 18½ in. high. They are 17 in. deep at the bench level and along the first shelf, and about 13 in. deep at the level of the upper shelf. Each is fitted with a cover which can be secured with a padlock. The small bench-mounted material lockers are about the same general dimensions as the tool lockers but are about half again as wide.

The color scheme for the shop is both attractive and functional. Light green is used for benches, lockers and other large area surfaces. Orange is used for signs.

junction boxes, control panels and light equipment. Working surfaces, such as the tops of benches and vises, are painted buff, while cranes, the ends of vises and other protruding places are painted yellow.

Daily records are kept of each man's production of air brake work. Defects in workmanship are recorded by the test rack operator, and a report turned in to the foreman each afternoon, so that incorrect procedures can be remedied quickly.

Each valve is marked to identify the man who overhauled it. The written record for each man and daily production has four columns. The first two show how many service and how many emergency portions were worked by the man. The next two columns show how many slide valves were defective and how many units were turned down due to defective piston rings.

One of the most impressive things about this air brake room is its extreme cleanliness and neatness. Working and storage areas and passage ways are immaculate. All material is stored neatly where it does not interfere with work or movement. This accomplishment is attributed chiefly to two things. One is an enlighted personnel program, termed human relations by the Southern Pacific, which has been unusually effective in creating a high morale and good working spirit among the employees. Second is a series of signs showing the name of the person responsible for the general safety and appearance of a department, or an area within the overall department.

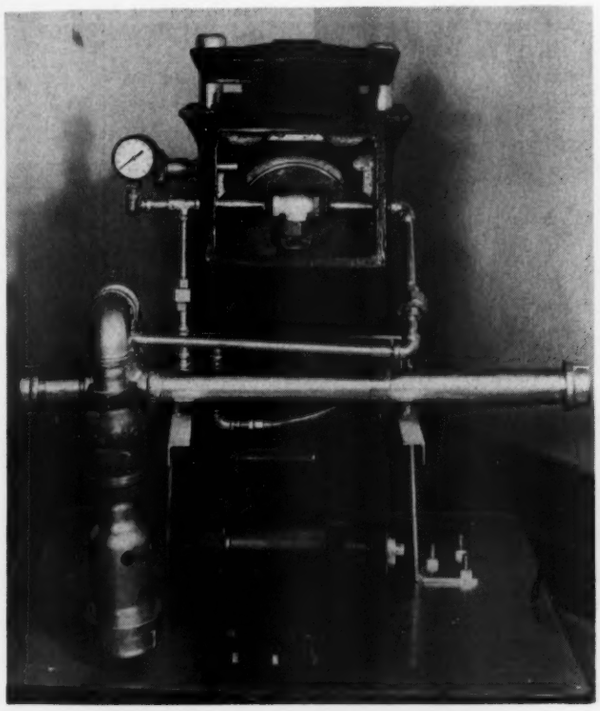


Fig. 1—Safety device for stopping a train with a hot box, shown rigged up for testing, does not interfere with packing or changing brasses

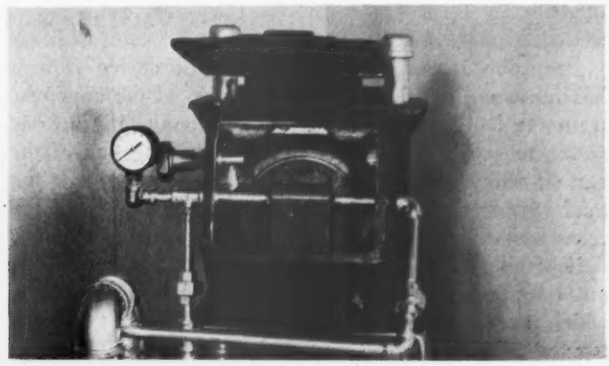


Fig. 2—Replacing the thermal fuse which operates the safety device requires only raising the hinged cover, loosening the coupling nut and inserting a new fuse

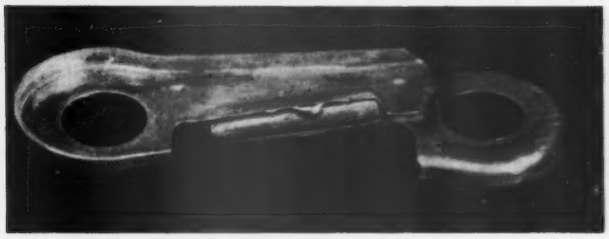


Fig. 3—The fuse is reinforced by a steel rod to prevent its breaking from vibration and impact. Small piping is made of malleable iron or steel for the same reason.

Device Stops Train If Hot Box Occurs

On Friday morning, January 16, a method of stopping a train in the event of a hot box was demonstrated at the A.A.R. test lab in Chicago. The device, developed and patented by A. J. Hebert of the Southern Pacific, P. O. Box 363, Lafayette, La., is tied into the train line and functions to bring the train to a stop whenever the bearing temperature exceeds 400 deg. F.

Detection of the overheated journal is by a fuse with a melting point of 160 deg. F. This is placed in the journal box between the journal and the lid. The 160-deg. setting was arrived at through experimentation as the temperature which is reached at the fuse location when journal temperature is 400 deg.

The fuse, shaped as shown in Fig. 3, squeezes together a pair of bell cranks on the bottom of the tee in Fig. 2 when the coupling nut is tightened. In squeezing one leg of each bell crank toward the center of the opening, the fuse holds a valve tight against a seat in the bottom stem of the tee. When the journal reaches 400 deg., the air surrounding the fuse is at 162 deg., causing the fuse to melt. This relaxes the grip on the bell cranks, allowing the valve to open.

When the valve opens, air flows through the ¼-in. piping and the tee from left to right by means of a connection to the train line from this piping on the left. This flow of air in the small piping lifts a spring-loaded valve in the main release chamber, the large object with the holes at the bottom left in Figs. 1 and 2. Lifting the spring-loaded valve off its seat discharges air in the train

line to the atmosphere through the holes in the bottom of the release chamber, and the train line reduction results in a brake application in the usual manner.

Braking Effort Can Be Changed

The type of application can be varied from light service to full emergency by choice of the spring. A stiff spring will cause only a light application because it will close the valve against the pressure remaining in the train line after only a slight brake pipe reduction has occurred. A lighter scale spring, on the other hand, will permit the brake pipe pressure to reduce to near zero before the spring will seat the valve and thereby shut off the flow of brake pipe air to the atmosphere. So that full emergency can be attained with a light spring, the total area of the five holes in the main release chamber is equal to the cross section area of the brake pipe, thus offering no restricted passage to the quick dumping of the air.

Provision is made for by-passing this device after it has functioned so that, at the discretion of the crew, the train can be moved from where it stopped to the nearest siding to avoid tying up the main line. Detection of the car on which the hot box has occurred is through the loud hissing sound made by the air escaping from the release chamber.

Replacing the thermal fuse takes but a minute. The nut on the bottom of the tee in the box is loosened, which permits the vertical legs of the bell cranks to come together. Tightening the nut with the new fuse in place again seats the control valve, and the device is ready for the road.

Location of the device is high enough to avoid interfering with repacking or adjusting the waste yet low enough to permit brasses and wedges to be replaced in the conventional manner. It is placed near the outside of the box so that it does not interfere with normal lateral movement of the axle.

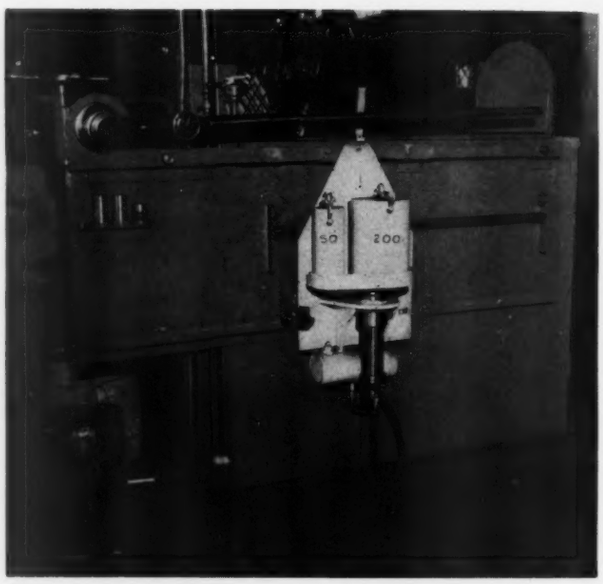
During road operation the tee in the journal box is protected by a $\frac{1}{16}$-in. hinged cap which is spring loaded to keep it in place as shown in Fig. 1. The cap is raised to the position shown in Fig. 2 when necessary to renew the termal fuse, which is illustrated in Fig. 3. This type of fuse is re-enforced along the center section by a steel rod to prevent it from breaking from impact and vibration, and thereby causing a false warning and unnecessary stop.

Independent of Outside Temperature

The cover also serves a second purpose. It acts as a reflector for the heat radiated to the thermal fuse. On tests conducted without the cover, the brass temperature which caused the fuse to melt would vary with the temperature of the air surrounding the box. With the cover in place, test data indicates that the surrounding air will have no effect on the brass and fuse-melting temperatures.

The series of tests which indicate independence from outdoor temperature was conducted by inserting a 1,300-watt heating element in the end of the journal at four different temperature conditions and noting the time required to melt the fuse. The four temperature conditions were: (1) 101 deg. in the sun; (2) 70 deg. in the shade; (3) 70 deg. indoors; and (4) 14 below in a food locker. In each case, 37 min. were required for the 1,300-watt heating element to raise the fuse to melting (160-deg.) temperature. Thus, while the heat source was an electric element rather than a hot journal, the indication is that ambient temperature will not effect the conditions under which the fuse will melt as a given heat source melted the fuse in equal times under radically different temperature conditions.

Present plans call for road testing of this hot-box detection device in the near future and the submission of the results of the tests to the A.A.R. for that organization's further study.



Test stand for checking the accuracy of torque wrench dial settings.

Torque Wrench Tester

To test the accuracy of torque wrench dial settings, a western road has built a simple but effective test stand which consists of a bar marked off in one, two and three foot intervals, one 50-lb. and one 200-lb. weight, a small hydraulic jack for lifting the weights in place for attachment to the bar, and a gear transmission to permit the torque wrench to work against the loaded bar.

To check that the dial registers the correct setting in foot-pounds, taking 600 ft.-lb. as an example, the 200-lb. weight would be attached to the 3-ft. mark on the bar. The dial is set at the 600 ft.-lb. mark and force applied to the torque wrench to lift the 200-lb. weight. Watching to see that the indicating light flashes as the weighted bar begins to move shows whether the dial is registering correctly.

The hydraulic jack is connected to the fluid pressure source by flexible hose. The stand which holds the jack and the weights is mounted on rollers so that the weights can be lifted into place by the jack at any of the three marked suspension points.

Movable Window Washer

A movable washer originally developed for use in cleaning truck and van bodies has been adapted to railroad service and an installation has been made on the Atchison, Topeka & Santa Fe at Albuquerque, N. M., where six passenger trains are given immediate window washing each day. The equipment, known as the Wilson washer, was built by the Ross & White Co., Chicago.

Two Wilson washers, mounted in this instance on Yale & Towne 2-ton lift trucks, are readily moved one to each side of any of the three tracks on which incoming trains arrive. The trains are washed either while standing or as they leave the station, in the latter case being pulled past the washing machines at a restricted speed of 2 to 3 m.p.h. which takes 5 to 7 min. for a 15-car train. Car sides are washed from a point slightly above the windows down to the bottom of the car side in a single pass with a limited amount of clear water, and the resultant improvement in window condition, particularly, is not only pleasing to passengers but accomplished with minimum expense.

Other advantages shown by Wilson washers in this application include: (1) no fixed foundation, water piping, electrical wiring or special drainage, as the unit is portable and the small quantity of water used dries rapidly or drains through the ballast; (2) the lift truck is available for other uses such as loading baggage cars or icing diners, when not needed for washing, as the washing equipment can be quickly removed; (3) the washers may be easily transported to another point if a change in operating conditions makes train washing in some other city desirable; (4) no detergents are required in order to assure getting clean windows; (5) express refrigerator cars and other types of cars may be washed if necessary during periods when the washers are otherwise idle.

The two movable washing machines at Albuquerque are used to clean an average of about 100 cars a day with a single operator on each machine, a total of 9,800 cars having been cleaned in the first three months after the machines were installed. It is reported that examination of the brushes showed little evidence of wear in that period.

Washer Construction

The Wilson railroad car washer consists essentially of two units: A lift truck rated at 4,000 lb. 24 in. from the vertical, complete with fluid-drive features; and the Wilson washer proper, composed of all of the mechanical equipment necessary for washing Pullman cars and coaches. The washing unit can be easily removed from the truck in about one minute.

The washer is completely self-contained, with its own supply of water in a 250-gal. tank on top of which is mounted a 9-hp. air-cooled high-speed gasoline engine which furnishes necessary power to operate a fluid pump and a water pump. The fluid pump delivers oil to a fluid motor with V belt drive to the 9-ft. by 18-in. diameter washing brush. The water pump delivers water to the water nozzles at sufficient pressure and volume to wet the car side and, after scrubbing, rinse it well. An 18-gal. oil reservoir tank is installed to hold the hydraulic fluid.

The brush is the same type as normally furnished with Blackhall fixed-type car washers, in other words Mexican white tampico fiber. The 9-ft. long brush revolves either clockwise or counterclockwise, depending upon the choice of the operator, at a speed fast enough for thorough scrubbing of the car sides.

Two spray pipes with nozzles are furnished, one for wetting down the side of the car prior to contact of the scrubbing brush and one final rinse to wash off the dirty water. The entire operation and control of this machine is at the fingertips of the lift-truck operator.

The Wilson washer, mounted on a lift truck and completely loaded with water, weighs approximately 12,000 lb. The brush can be moved in and out of the washing position, through a control conveniently located on the steering column. The brush and boom float on a double-roll ball-bearing assembly in a machined, grooved track. The brush is pivoted at the center so as to adhere to the car side in case the car body tilts slightly for any reason.

In washing passenger cars with this machine, the operator can vary brush pressure against the sides of cars without damaging any of the operating mechanism on the washer. The hydraulic system is designed to prevent excessive pressures building up when brush pressure becomes high and there is a tendency for the brush to slow down and stall.

The washer is heavily constructed throughout and designed for 24-hr. service without overworking the equipment. Experience at Albuquerque indicates that it can be used to advantage for washing railroad cars at any location where a hard-top or concrete runway with a width of 8 ft. is available.

Are Solid Journal Bearings Neglected?*

Surveys suggest a positive answer and demonstrate possibilities for improvement. Why not more servicing and fewer hot-box delays?

By JAMES G. DICK†

THE journal bearing, particularly in freight-car service, must absorb more continuous punishment and more rigorous extremes of operating conditions than any other generally similar bearing type. The basic function of the bronze back is the support of the relatively low-strength babbitt metal wearing surface. It is also functional in sustaining the wear and absorbing the shocks attendant upon the movement of the bearing, during normal running, car-to-car impact and the application of the brakes, against a steel wedge and steel box parts. In addition to this, it must take care of all wear and stress conditions entailed by the restriction of the lateral movements of the car and its related parts, and by the control of the forces underlying these lateral movements. The babbitt-metal wearing surface is formed from a comparatively plastic material. It is this plasticity that permits the solid journal bearing to perform satisfactorily under the most severe of operating conditions.

The fact that the bearing can and, indeed, does frequently operate under adverse conditions, instead of enhancing its reputation for trustworthiness, has only served as an incentive to permitting these conditions to deteriorate until eventually a point is reached where a poor performance record is obtained. This point was reached long ago and the hot-box conditions are but its manifestations.

Effect of Worn Journal-Box Parts

The load which must ultimately be carried by the bearing is applied by the box roof to the wedge and from the wedge to the bearing back. The wedge and the box roof must contact each other in a manner permitting free movement of the parts in order to maintain the load application along a vertical axis. Unequal load distributions initiated as a result of a box roof that has become worn and concave cause lubrication failure and bearing lining distortion.

The effect introduced by a wedge that does not display the proper convexity at its point of contact with the box roof, is very similar and causes difficulties of an identical nature.

The wedge may also be found to be worn at its points of contact with the back of the bearing and, where this situation exists, it can cause at least a partial application of the load to the sides of the bearing. A pinching action of this type results in high stress concentrations along the babbit surfaces immediately adjacent to the oil grooves, and lining deformation with lubrication failure and temperature rise may occur at these locations.

Operating Forces on the Bearing

With the conventional type of freight-car truck frame vertical and lateral shocks occurring during car movement are largely absorbed by the bearing. In addition to these, such horizontal shocks as result from car-to-car impacts in the yards during humping and on the road must also be considered as contributing to the sum total of what must be absorbed by the bearing. Where these shocks are not exaggerated by improper wedge and box roof conditions, and where the impact speeds are reasonable the performance of the bearing is not seriously affected.

With the type of brake used on freight-car trucks the braking force is applied to each wheel through a single brake shoe and, therefore, in one direction only. The application of the brakes will cause the forcing apart of the two pairs of wheels and their journals. This action causes movement of the journals within their boxes and a shift in the position of each journal in its bearing. On heavy brake applications an examination of the interior of the journal box during the application will indicate that the bearing, on that side of the journal nearest the brake, has lifted from the journal surface as a result of journal movement during braking. Separation of this nature provides focal points for waste grabs and, therefore, hot boxes.

A journal movement of this nature is, in most cases, accompanied by contact of the journal with the inner edge of the dust-guard well farthest from the brake. Repeated contact in this manner results eventually in excessive wear of the well at this location and permits thereby increased journal movement and exaggerated momentary decentering of the bearing on the journal during braking. That this action occurs very frequently is clearly exemplified by even a casual examination of the journal bearings removed from freight-car service. A significantly high percentage show babbitt deformation along one side.

Where the clasp brake design is involved, this movement of the journal does not take place since equal braking forces applied at diametrically opposite points on the wheels prevent it.

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* From a paper presented before the November meeting of the Canadian Railway Club at Montreal, Que.

† Chief chemist and metallurgist, Canadian Bronze Co., Montreal.

Lubrication

Lubrication of the solid journal bearing in service has been accomplished since the time of the introduction largely by the waste-pack method. Under reasonably good conditions, the waste pack will provide for adequate lubrication of the bearing. Such conditions frequently do not exist, however, and there are many instances where the solid bearing must function with but border-line lubrication.

Foreign matter may enter the box past the box lid or past the dust guard. The design, fit and maintenance of the lid should be such as to allow complete sealing of the front opening of the box during car operation. Too often, however, this is not the case and the flapping and banging of poorly secured box lids is not at all an uncommon sound in freight-car operations and, on many occasions, is only exceeded in frequency by the sight of journal boxes lacking their lids entirely. The present wooden dust guard would certainly appear to offer little in the way of active resistance to the passing of foreign material through the rear of the box and, eventually, into the waste and oil packing.

As the result of these findings the bearing manufacturers of Canada have adopted the higher-zinc-content bearing as standard, with a range of zinc content specified between 4.5 per cent and 2 per cent. The A.A.R. has now taken steps to insure that the permissible zinc-content range now specified allows adherence to the desired values.

Manufacturing Control

Several years ago a system of stastical analysis was applied to the journal-bearing production operations of the Canadian Bronze Company. The purpose was to determine each individual reason for the rejection of bearings for defects caused by vagaries in the manufacturing process. A concerted attack was made on the causes found to underly these rejections. In the four years since this program was inaugurated internal rejections have been reduced by 75 per cent.

In referring to articles dealing with the yearly costs of hot-box delays, Mr. Dick said that in some cases the picture had been distorted in order to prove some specific point. Even where the costs have been derived properly, however, they are of significant proportions. He believes that some attempt should be made to determine, without bais, whether an increase in yearly expenditure to improve journal-bearing operating conditions would not result in a yearly saving in delay costs far exceeding the expenditure involved. Where tests are conducted to determine the efficiency of a new type of oil, a new grade of waste or a better system of sealing the front and back openings of the box care is taken to insure that all conditions are normal: that a good roof contour, absence of wear on the inner edge of the dust-guard well, new dust guards, etc., exist before the test is started. The packing in such boxes is adjusted properly at all service points and care is taken to see that the details of Rule 66 are adhered to. In such instances, Mr. Dick said, a hot box very rarely ever occurs and the care taken is justified by the results secured. The means to a better solid bearing performance obviously exists, he said. They only await the will to apply them and the determination to succeed.

—Editor

SUMMARY OF DEVIATIONS FROM STANDARD PRACTICE FOUND IN SURVEYS OF JOURNAL-BEARING CONDITIONS ON THE CANADIAN RAILWAYS

	Findings of two surveys several months apart (same territory)	
	First	Second
New journal bearings piled incorrectly	10	9
New journal bearings noted in damaged condition	14	6
Journal bearings noted piled incorrectly or damaged in emergency or petty stores, especially at stations	13	5
Inadequate attention to passenger trains at divisional points as far as journal boxes were concerned	2	1
Freight trains receiving service treatment on arrival at yards but no inspection of boxes before departure, although spot check indicated packing in need of adjustment	6	2
Very cursory examinations of freight trains without adjustment of packing or additions of oil which inspections showed were needed	11	7
Service treatment of freight omitted because of insufficient staff and lack of sufficient yard time	10	5
Number of visits to repair tracks where insufficient interest was shown by staff in properly cleaning out boxes, or in giving proper attention to condition if journal bearings and wedges before repacking. Careless handling of packing irons and presence of dirt in dope pails was also noted	15	17
Car men on repair tracks rebrassing boxes without recognizing that the journal was scored or improperly machined	4	2
Cabooses and baggage cars in which bearings were found in a damaged condition	48	19
Excessive wear in journal boxes, including box tops, back of box and between wedge stops, found on repair tracks	10	3
Packing applied to journal box in small separate portions	1	—

Regardless of any improvement in the condition of the parts surrounding the bearing, its efficiency in service operation will continue to depend largely on the degree of effectiveness of and the adherence to proper maintenance standards. Over a period of many years a set of rules and regulations has been devised by the A.A.R. and by the individual railroads to govern the essential requirements involved in the maintenance of these bearings. Any deviation from what has been established as standard practice can only result in the appearance of adverse operating conditions and a lowering of the efficiency of bearing performance. And yet the tendency to deviate from them appears not only to be general today, but to be on the increase.

Surveys of Maintenance Practices

The organization with which I am associated has never divorced itself from a consideration of the maintenance conditions under which its product must perform. During recent months we have conducted two complete and extensive surveys with a view to compiling the information secured on the maintenance conditions pertaining at a large number of locations on the lines of the Canadian railways and presenting our findings to the officers of the respective mechanical departments. Permission to conduct these surveys was granted to us by these officers and the reports which we turned over to them indicated the incidence of deviations from standard maintenance and inspection practices for journal bearings. These officers were most co-operative in reviewing the accumulated data presented to them and in taking steps to correct many of the deviations that were uncovered. This, I believe, was the first time that a full picture of the situation has been prepared and presented to the Canadian railroads by a bearing manufacturer and the satisfactory outcome of these surveys has doubless laid the foundation for further investigations.

During the first survey our service engineers visited a large number of locations where journal bearings were being serviced from large rip tracks down to caboose and

baggage-car bearings storages. In our reports to the mechanical-department officers, however, we at all times avoided giving any details as to the locations of the repair points, stations, etc., where the deviations from standard practice were found. We confined ourselves to reporting only the nature of the deviation and the incidence of its occurrence. Our thought in this connection was that, after the steps taken by the mechanical department officers to improve maintenance conditions had been in force for some time, we would resurvey the situation in order to determine whether the deviations found originally at the various locations, known only to ourselves, had been corrected. A summary of the results of these two surveys is presented in the table.

Although the car foremen are not themselves responsible for seeing that journal bearings in the stores are correctly piled, they can make it a point to detect instances of improper piling and cases of mishandling of bearings during transit from stores to repair tracks. Where bearings are found to have damaged surfaces, these should never be applied to car journals.

One mechanical officer has suggested that the journal bearings shipped by the manufacturer should be packaged in order to prevent damage in transit, in the stores, and in the yards. This suggestion is certainly a constructive one and damage of this nature can be expected practically to be eliminated if and when bearings are packaged before shipment.

The condition of the journal at repack and rebrass should always be determined and under no conditions should a damaged journal be returned to service.

In the case of packing adjustment at train inspection it is essential that all journal boxes be inspected and that packing be adjusted wherever necessary. Frequently during our surveys it was noted that insufficient staff or insufficient station time existed for proper inspection. Where such circumstances pertain, adjustments in staff or in station time could be made with advantage.

Some of the mechanical-department officers of Canadian railroads have expressed the thought that, with proper journal-box inspection and packing adjustment at the starting terminal, some of the divisional inspection points along the line could be eliminated on through freight trains, with more time for proper inspection being permitted at the remaining point or points.

Our surveys disclosed the fact that a very considerable number of car men appeared to be incompletely familiar with the details of the proper method of packing a journal box and the proper oil saturation level. It was directed by the mechanical-department officers, after they had gone over our findings in this connection, that each car foreman should spend at least one-half hour per week demonstrating to his car inspectors the proper method of packing and servicing journal boxes. This is particularly important in the case of men working on night shifts. Our surveys indicate that a large percentage of night-shift men are improperly instructed and display indifference to the proper methods of maintenance and inspection.

The practice of cleaning journal boxes at repair tracks was found to be quite poor at many locations. There is little point in repacking, or in rebrassing and repacking, if previously existing dirt, oil and wool fibers are to be left adhering to the box sides, lids, tops an dbottoms and permitted the chance of interfering with the effic ency of subsequent performance.

Higher-Zinc Bronze

Mr. Dick related that, using the normal methods of fluxing and tinning, it was found that the room-temperature bond strength between the bronze back and the bearing metal increased with increasing zinc content of the alloy of the bronze back. With one per cent zinc the bond strength was 9,000 p.s.i.; with three per cent it was 13,000 p.s.i. After the higher-zinc-content bearings had been in service for some time, further tests indicated that a bearing with three per cent zinc content, heated to 200 deg. F. and cooled, retained 90 to 98 per cent of its room-temperature bond strength, while a bearing with one per cent zinc content, treated in the same manner, was able to retain only 60 to 65 per cent of its room-temperature bond strength.—Editor.

Passenger-Car Diaphragm Hanger

The Little Rock shops of the Missouri Pacific hangs passenger car diaphragms with an attachment that fits platform trucks.

As shown in the illustration, the two vertical posts of the attachment fit the truck platform; they are secured to the front of the truck table by set screws. The 45-deg. support for the attachment hooks over a vertical plate on the rear of the table and is held to this plate by a bolt.

The diaphragm itself is lifted and held for attachment to the car by a channel section 1½ in. wide and 1 ft. long where the three supporting members of the attachment join. The channel supports the diaphragm by the outside framing section.

Questions and Answers

Diesel-Electric Locomotives*

Eddy Current Clutch (*Continued*)

701-Q.—At what time does rotation of the latter half of the coupling occur?

A.—Rotation of the latter (and fan rotation), will occur only when the radiator fan relay excites the clutch field winding.

702-Q.—Where does the excitation come from?

A.—The locomotive control power.

703-Q.—What determines the amount of excitation (and fan speed)?

A.—This is determined by the temperature of the diesel engine water.

704-Q.—When does high excitation of the clutch field winding take place?

A.—When the temperature is high the radiator fan relay will allow high excitation.

705-Q.—What is the result when high excitation takes place?

A.—This causes the coupler half containing the field winding to be driven at a speed approaching that of the other coupling half. In other words "slippage" between the coupling halves will be low.

706-Q.—What is the action when less cooling action is needed?

A.—The radiator fan relay reduces clutch field excitation and the field half of the coupling slows considerably (greater slippage) below the speed of the other half.

707-Q.—Where is the Eddy Current Clutch located?

A.—Next to the rear traction motor blower on freight and passenger locomotives, and in the radiator compartment of the road switcher locomotives.

708-Q.—What is the purpose of the Radiator Fan Gear Unit?

A.—This is a right angle gear employing bevel gears to change the horizontal drive of the eddy current clutch to a vertical drive for the radiator fan and is connected to the clutch by a short shaft.

Radiator Fan

709-Q.—How many radiator cooling fans are used?

A.—A single radiator cooling fan is used.

710-Q.—Where is it located?

A.—In the roof of the locomotive directly above the radiator fan gear unit.

711-Q.—Describe the fan operation.

A.—Driven by the gear unit vertical shaft, the fan draws cooling air in through the radiators which are mounted inside the shuttters in the side walls of the locomotive. The fan exhausts the cooling air through a circular opening in the roof.

Engine Temperature Switch (ETS)

712-Q.—Describe the Engine Temperature Switch.

A.—This is a temperature sensitive switch operated by a bulb and bellows assembly. When engine temperature reaches 185 degrees-F. the switch closes.

713-Q.—What happens when the switch closes?

A.—The alarm and warning equipment then operate, and the engine speed is reduced to idle.

714-Q.—On all locomotives (Freight, passenger and road switchers) built after 1948, what does this device consist of and where is it located?

A.—This device is a Detroit Lubricator Switch, and it is mounted adjacent to the radiator fan relay.

715-Q.—What device is applied to road switching locomotives built in 1946-47-48?

A.—A Fenwal temperature switch is installed in the right engine water outlet header.

716-Q.—Does this switch incorporate a bulb and bellows assembly?

A.—No.

Operation

717-Q.—What measures the engine cooling water temperature?

A.—A bulb and bellows assembly.

718-Q.—Where is the bulb located?

A.—In the right hand diesel engine water outlet header, and is connected to the bellows by a tube.

719-Q.—Where is the bellows located?

A.—The bellows is located in the radiator fan relay panel.

720-Q.—What is contained in the assembly?

A.—Each bulb-tube-bellows assembly contains a temperature sensitive fluid.

721-Q.—How does this fluid respond to an increase in temperature?

A.—As the temperature of the engine cooling water increases, the fluid in the bulb expands and pressure is transmitted through the tube to the bellows.

* This series of questions and answers relate specifically to the Alco-G.E. Diesel electric locomotives. The figure numbers and references, by number, to diagrams, etc., relate to the current edition of the Alco-G.E. operating and maintenance manual.

722-Q.—What action takes place as the pressure in the bellows rises?

A.—A piston in the bellows rises and forces a movable contact against a stationary contact.

723-Q.—In what temperature range will the contacts meet?

A.—The contacts will meet in the 150-155 deg. temperature range.

724-Q.—What is the resulting flow of current as the contacts meet?

A.—The contacts pass current from the locomotive's control circuits to the radiator fan relay motor.

725-Q.—What then takes place?

A.—The motor begins to rotate, and through a gear box it turns the brush arm of a rheostat.

726-Q.—In which circuit is this rheostat?

A.—In the eddy current clutch field circuit.

Schedule 24 RL Air Brakes

F.S. 1864 Relay Valve

1484-Q.—What happens after air from passage 16 flows through passage 19.

A.—Pressure is released from diaphragm chamber *K* through choke *142* and the inshot portion exhaust.

1485-Q.—What is responsible for the gradual reduction in braking pressures as train speed decreases?

A.—The chokes, *138*, *140* and *142* control the rate of exhaust from diaphragm cavities *P*, *N* and *K* to produce a gradual reduction in braking pressures.

1486-Q.—How does a reduction of pressure in the displacement reservoir affect the diaphragm chambers?

A.—When displacement reservoir pressure is reduced, a corresponding reduction is made in diaphragm chambers *A*, *K*, *N* or *P*, whichever is in control.

1487-Q.—Explain this operation further?

A.—As the pressure is reduced in passages *16*, *16a* and the check valve chamber, the greater pressure in the controlling chamber *K*, *N* or *P* lifts the check valves *51*, *51a* or *51b* and reduces into passage *16*.

1488-Q.—What happens after the pressure is reduced in passage 16c and chamber C below the inshot valve?

A.—Spring *88* returns the inshot piston *84* and diaphragm *85* and opens supply valve *92*.

1489-Q.—What brings about an eventual release of brake cylinder air?

A.—As the pressure is removed from the diaphragm side of main diaphragm *38*, the higher brake cylinder pressure in chamber *F* of the relay portion and spring *42* return piston *36* and its lever *43*. With pressure removed from exhaust valve *23* and its piston *25*, brake cylinder opens them and flows to atmosphere.

Wiring

1490-Q.—How many brake wires are on the locomotive?

A.—Four brake wires are on the locomotive and are contained in a cable which extends throughout the length of the locomotive unit.

1491-Q.—What do these wires consist of?

A.—These train wires consist of: Application wire (AA); Release wire (AR); Return wire (AB) for the 64 volt locomotive battery and B + wire for 64 volt *A* locomotive battery supply to the DE-1 Back-up valve on the last car of the train.

1492-Q.—How are the application and release wires connected?

A.—In parallel between a master controller on the locomotive and the application and release magnets of the No. 21-B magnet brackets on the locomotive and each car.

1493-Q.—What operates the magnet valves?

A.—These magnets are energized or de-energized simultaneously by the master controller.

1494-Q.—What action results from the operation of the magnets?

A.—Application or release of the electro-pneumatic straight air brakes in accordance with the movements of brake valve handle on the "A" locomotive.

1495-Q.—How many speed governor wires are provided?

A.—Four speed governor wires are provided in the cable and extend to the rear of the locomotive.

1496-Q.—How are these wires designated?

A.—AC-Low speed (L.S.) speed governor wire; AD-Medium speed (M.S.) speed governor wire; AE-High speed (H.S.) speed governor wire and AG-Battery return wire.

1497-Q.—How are the wires connected?

A.—Between the respective magnets of the F.S. 1864 Relay and the relay cabinet.

1498-Q.—How do the relays in the relay cabinet function?

A.—The relays in the relay cabinet operate at predetermined speeds to energize or de-energize the magnets of the F.S. 1864 relay valve and thus regulate braking pressures on the locomotive in proportion to train speeds.

1499-Q.—How are the train speeds measured?

A.—By the axle generator on the locomotive.

Speed Governor Control

1500-Q.—What is the basic principle of speed governor control?

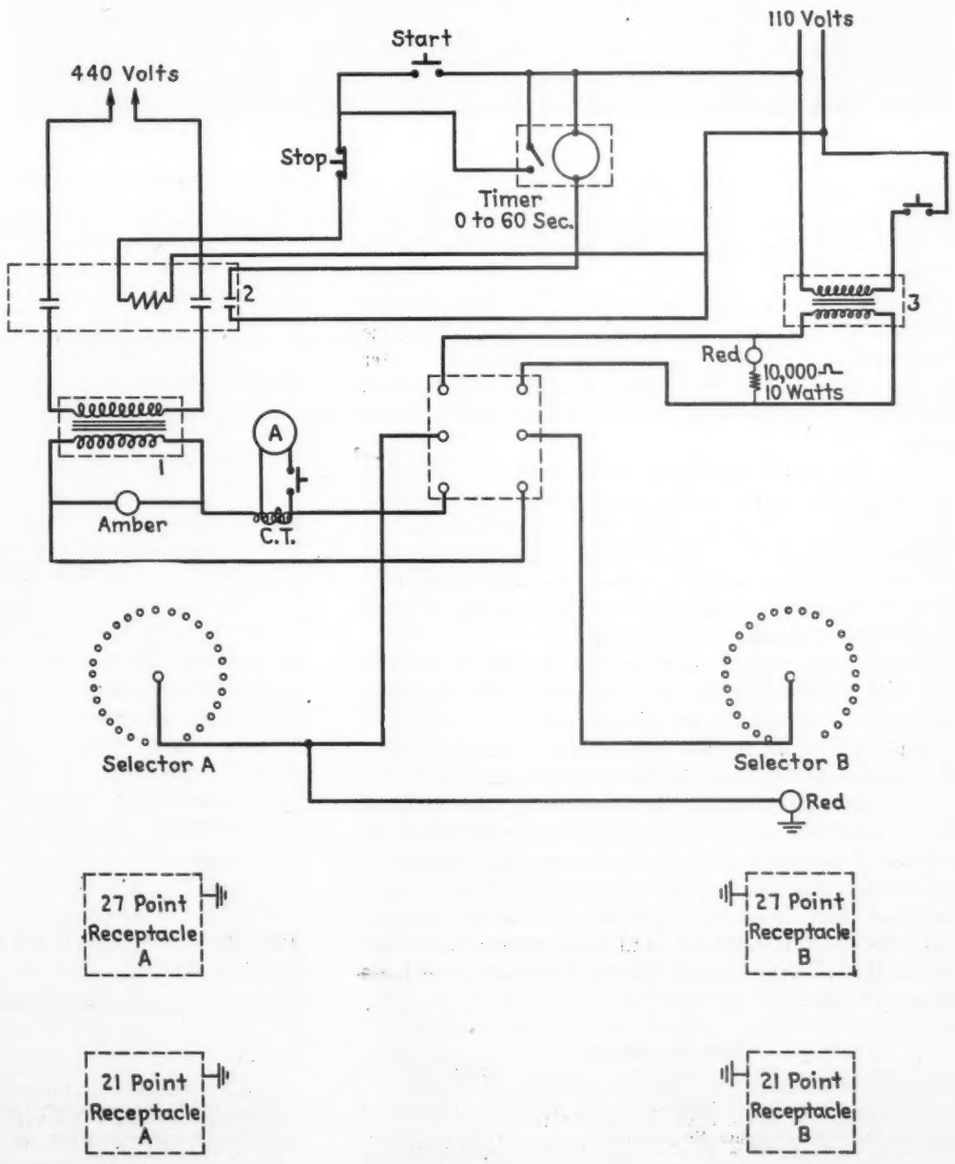
A.—The use of a generator attached to the axle of one pair of wheels of each car and "A" locomotive the voltage of which is proportional to wheel speed.

Jumper Cable Test Panel

THE Missouri Pacific has developed means for testing the multiple conductor control jumper cables used between diesel-electric locomotive units which includes a high-potential and a current-carrying test for each conductor in the cable.

The panel consists basically of a current source, approximately 100 amp., and a high potential source of 800 volts. The 440-volt, single-phase a.c. is transformed on the current side to give a 50-volt, 100-amp. secondary. The output is fed to the two selectors through a two-pole, double-throw knife switch. Each contact on the selector is connected to the corresponding number on either the 21 or 27 pole receptacle.

To test a jumper cable, the two selectors are set to the *OFF* position, the cable is then plugged in the proper receptacle, each selector is then turned to the No. 1



Wiring Diagram

1—Special transformer made at Sedalia, Mo., shops. 440-volt primary, 50-volt, 100 A secondary

2—Magnetic starter—Westinghouse Class 11-200NSO. 2-pole, 440-volt, for use with remote PBS with 110-volt holding coil

3—Stancor No. P-6007 transformer. 120-volt primary, 800-volt, 110 M.A. secondary

Point *1* on each *A* receptacle is connected to point *1* on selector *A*, point *2* to point *2*, etc. Similarly all points on each *B* receptacle are connected to corresponding points on selector *B*

A faulty conductor is spotted surely and quickly when it is plugged into the test panel

position and the double-pole, double-throw switch is placed in the continuity position. The continuity start pushbutton is then closed, thus energizing the No. 1 cable.

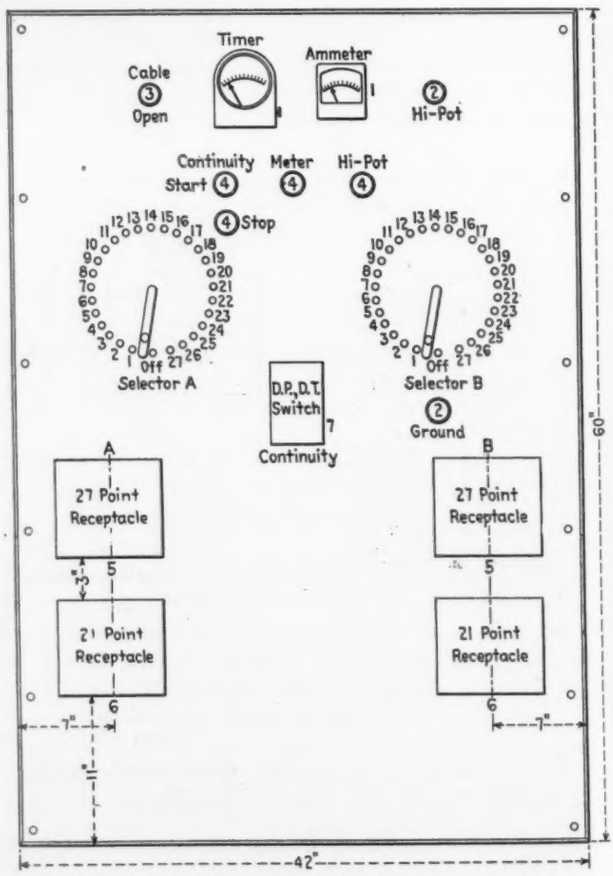
The timer in the continuity control will run a preset time of approximately 10 seconds and then de-energize the transformer. While the timer is running, the meter is read. This is done by closing the meter pushbutton. Should the cable be open, the amber light will be energized.

After the No. 1 conductor is checked, the selectors should then be turned to the No. 2 position for checking of the No. 2 conductor. This is the procedure to be followed until all 27 conductors have been checked. If the meter readings are all constant, the cable should be okay for continuity. If a conductor is grounded, the red ground light indicator will light up.

If, at any time, it is necessary to stop the continuity test, the *stop* pushbutton will de-energize the two-pole contactor, de-energizing the circuit.

When all 27 steps have been checked for continuity, the selectors are returned to the *off* position.

For the high potential test, the double pole, double-throw, switch is placed in the high potential position. Selector *A* is placed in the No. 1 position and selector *B* is placed in the No. 2 position. The high potential pushbutton is then closed for a period of 15 to 30 seconds. This procedure is followed until all positions have been tested. If a short is found, the red hi-pot bullseye indicator will light.



Panel Arrangement

1—Ammeter—Weston Mdl. No. 734, range 5 amp., scale division 50, with current transformer Mdl. No. 604, ratio 200/5 type 1
2—Indicator bullseye (red)—Westinghouse No. 1513107
3—Indicator bullseye (amber—Westinghouse 1513107
4—Pushbutton—Westinghouse No. 1470133
5—27-point receptacle—Pyle National Type WWRB receptacle housing and Type WWR 270 male contact unit
6—21-point receptacle—Pyle-National Type WWRB receptacle housing and Type WWR 210 male contact unit
7—DPDT selector switch—FA Type B—No. 10320T knife switch
Wires for current-carrying test are No. 8 asbestos insulated. Others are No. 14 switchboard wire.
Panel frame is 15-in. deep, all-welded from 2-in. x 2-in. x 3/16-in. angles

Fig. 1—Dynamic braking is used to advantage in all types of service on mountain grades. Photo courtesy Denver and Rio Grande Western.

Dynamic Braking For Low-Grade Lines

A control system developed by the General Electric Company automatically provides maximum permissible dynamic braking capacity throughout the operating range of the locomotive

ORIGINALLY intended as a means of controlling both passenger and freight train speed on mountain grades, dynamic braking has been refined to the point where it is increasingly used for controlling freight train speed in relatively level territory. As a rule, the reduction of braking effort as the speed decreases, makes the braking rate too slow for passenger trains operating where grades are light. A recent refinement of braking control which takes advantage of additional traction motor capacity available at lower speeds was described in a paper, "Dynamic Braking on Diesel-Electric Locomotives," by A. V. Johansson and H. R. Stiger, both of the Locomotive and Car Equipment Division, General Electric Company, Erie, Pa., which was presented at the Winter General Meeting of the American Institute of Electrical Engineers held in New York, Jan. 19-23, 1953. Extensive service tests, the authors state, have demonstrated the operational and economic value of this form of braking.

Dynamic Braking Limitations

During dynamic braking the diesel engine is normally operating at idle speed. This reduces the ventilation to the traction motors, and consequently their rating. Therefore, it often becomes necessary to increase the motor ventilation over what it is with the engine idling. Various methods are used, depending on whether the traction motor blowers are mechanically or electrically driven. The amount of ventilation required depends on the braking requirements which, in turn, depend on the locomotive application. On special locomotives, this requirement is cared for in the design. On standard locomotives, the braking provided is, naturally, that which can be most economically obtained, consistent with high quality. Operating experience indicates that it meets average requirements.

Normally the requirements on the traction generator are not limiting during dynamic braking. Rather, the traction motors are the limiting part of the system in the following ways:

1. Field current (I_f), which is limited by heating.
2. Armature current (I_a), which is limited by heating.
3. Peak volts per bar (V/B), which is limited by motor design.

The way in which these effect a braking effort curve is shown in Fig. 3. In the past, armature current during braking had to be limited to a maximum value that would not exceed the safe heating limit of the motors at

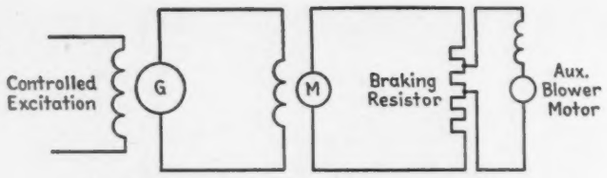


Fig. 2—Fundamental circuits for dynamic braking.

high speed where the core loss is greatest. This meant that the braking effort followed the Constant I_a curve in Fig. 3, and the maximum possible braking effort available at lower speeds could be utilized. The latest Alco-G. E. system, described in the paper, provides automatic control of the traction motor current to hold it within safe heating limits at all speeds. The result, as shown in Fig. 3, is that greater braking effort is available at lower speeds. At higher speeds the peak volts per bar limit still exists. This requires a manual reduction in motor armature current as indicated at the right hand end of the curves in Fig. 3.

Operating Advantages of Dynamic Braking

Years of operating experience, first with regenerative braking and later with dynamic braking also, have served to demonstrate certain advantages inherent in these systems. With the increasing popularity of the diesel-electric locomotive during the last decade, these advantages assumed new importance, and railroads tried to evaluate them more accurately. In a report on a series of extensive tests conducted by a large western railroad, the economic advantages of the dynamic brake are listed as follows:

1. Reduction in the number of overheated wheels in both freight and passenger equipment.
2. Elimination of long, costly stops for wheel cooling in heavy grade territories.
3. Reduction in number of thermal cracked wheels.
4. Reduction in wheel wear as a result of reducing the use of air brakes to a minimum.
5. Reduction in wearing of parts of brake rigging and attachments.
6. Reduction in brake beam and brake beam attachment failures.
7. Reduction in number of derailments caused by failures of brake beams and brake beam attachments.

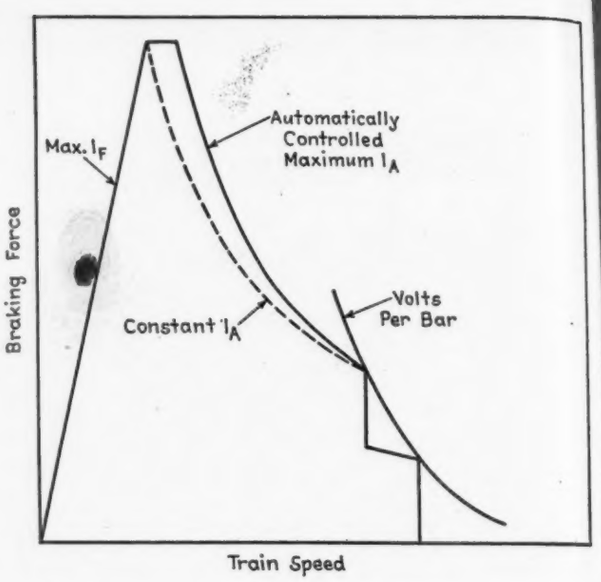


Fig. 3—Braking force curves, showing the effect of automatic control of armature current.

8. The ability to reduce train speed with the dynamic brake in conjunction with the air brake without attendant brake shoe and wheel damage.
9. Better train handling in regard to slack action where dynamic brake is properly used.

Braking Resistors

A suitable resistor, Fig. 4, must be provided to control the amount of energy produced by the traction motors and, therefore, the braking force of the locomotive. The design and construction of a locomotive-mounted resistor for dissipating such large amounts of power is not simple. Yet, it appears safe to say that the problem is simpler with a fixed resistor load than it is with regenerative braking where the power system is the load. In that case the voltage level of the power system is constantly changing, often very sharply, over a wide range.

Practically all dynamic braking resistors are forced ventilated. This is necessary because space is at a premium. In nearly every case, the blower is driven by

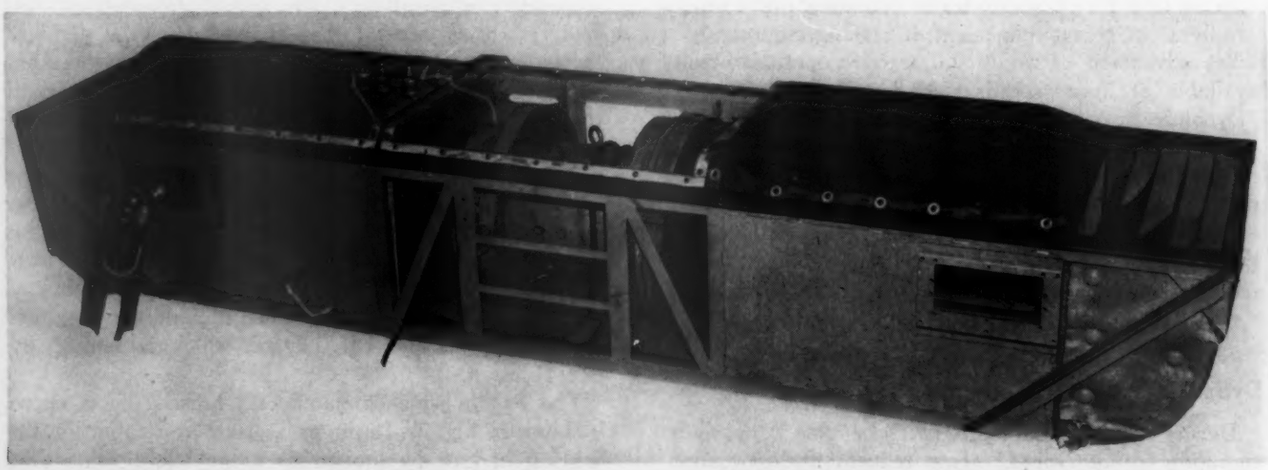


Fig. 4—Forced ventilated dynamic braking resistor assembly.

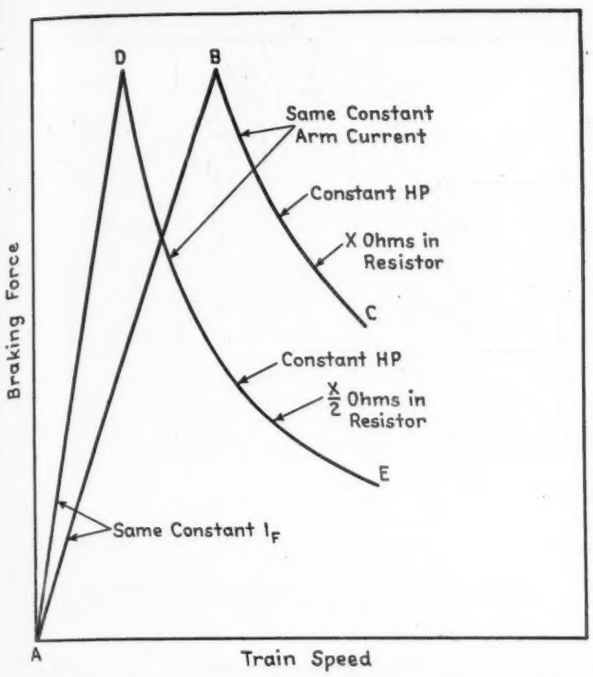


Fig. 5—Typical braking force curves, showing effect on varying ohmic value of braking resistor.

a series motor that receives its power from connections across a portion of the braking resistor itself. This provides a dependable source of power and eliminates the need for control devices. It has the advantage that the blower motor runs at a speed roughly proportional to the load on the grids which it must cool. Therefore, maximum cooling is provided when the resistor load is greatest. This connection also provides a system characteristic such that when the greatest braking effort is required, the blower load is a maximum and helps supply some of the braking force. Since the power developed by the traction motor in dynamic braking must be thrown away through the resistor, the power to run the blower motor costs nothing.

Control of Dynamic Braking

The value of dynamic braking would be largely lost if an effective method of controlling it did not exist. An important part of such control lies in the selection of the value of resistance for the braking resistor. How this resistance determines the braking curve is illustrated in Fig. 5. This shows two curves of braking force, *ABC* and *ADE*. Curve *ABC* has a braking resistor twice that of *ADE* in ohms. Lines *AB* and *AD* represent maximum field current which may be applied to the traction motor without excessive heating. This is the same for both curves. Figure 5 shows that, other things remaining the same, half the resistance allows maximum braking force to be obtained at half the train speed. The armature current is the same for both curves, so the braking horsepower depends on the resistance and will be in proportion to the resistance value selected. These curves also show that maximum braking force is independent of resistance; but, braking force for any particular speed—above that for maximum braking—is directly proportional to resistance and, of course, to horsepower. Since the horsepower is a function of the resistance selected—assuming traction motor field and armature current ratings to be fixed—the train speed for maximum braking effort will rise in proportion to the horsepower.

Control of Dynamic Braking by the Engineman

Most diesel-electric locomotives are equipped for multiple-unit operation. In such use, the engineman must be able to control all units by operating a braking handle in the lead unit. With this handle he ultimately controls field current, from a separately excited source, for the traction motors. By watching the traction motor ammeter, he controls the run-in of slack on the train when he first applies dynamic braking, and later avoids exceeding the operating limits imposed upon him. A brake warning relay in each unit, connected across a portion of the braking resistor, detects overvoltage and provides an indication on a warning light trainlined into the leading cab.

Alco-G.E. System of Dynamic Braking

The dynamic braking control equipment on a modern Alco-G.E. locomotive is described in the paper as follows: It includes the braking resistors and a pneumatically operated, two-position braking switch which sets up motoring or braking connections. In addition, two braking relays set up control and excitation circuits for dynamic braking, and a third relay provides the brake warning as described above. In the engineman's control stand there is a commutator rheostat geared to the braking handle. The brush arm is connected potentiometer style to provide a source of voltage which may be sent back over a train wire to the other coupled units. This voltage determines the amount of traction motor field current provided—up to the limit of traction motor armature current. When this point is reached the armature current provides a signal which overrides the manual control and automatically regulates the field current to maintain a predetermined armature current. On some types of Alco-G. E. locomotives, the armature current is modulated by train speed. Additional dynamic braking equipment consists of certain reactor windings used only in dynamic braking, a small rectifier and certain small resistor tubes.

Figure 6 shows a schematic diagram of the system with most contacts and adjustments omitted for simplicity. At the left of the sketch are four traction motors (numbered *4, 2, 3* and *1*) and their braking resistors. Across a portion of the resistor for motor *3* is the blower motor *K4* and the brake warning relay *BWR*. Across another portion of the same resistor is the current measuring coil on the reactor *X3*.* This coil and its associated resistor are used to measure braking current in terms of voltage across a portion of the resistor.

The traction generator *G* is shown connected to supply current to the four traction motor fields in series. The common connection of the generator and the four traction motor armatures simplifies the switching required to go from motoring to braking. It also provides ground relay protection during braking through the relay coil *GR*. The generator starting winding, a series winding used in cranking the engine, is connected in the generator cir-

* The saturable core reactors referred to in this article have one a.c. coil wound on an iron core and one or more d.c. coils. With no d.c. flowing, the a.c. coil offers a maximum impedance to the flow of a.c. Control current in the d.c coils tends to saturate the core and reduce the impedance of the a.c. coil.

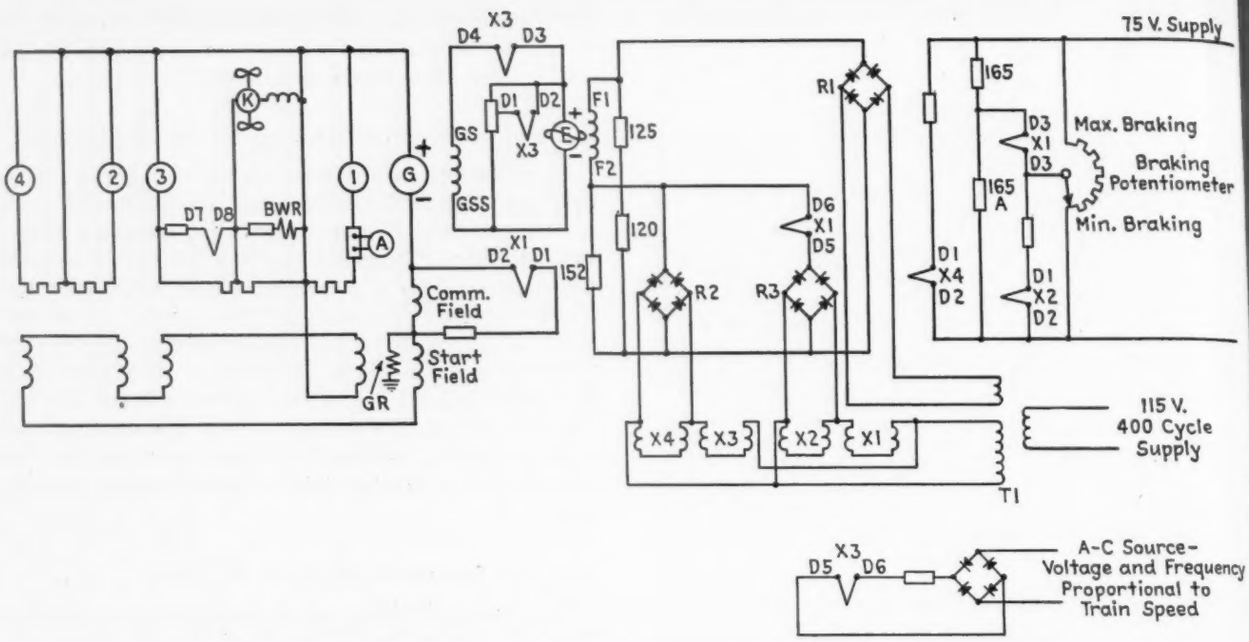


Fig. 6—Simplified schematic diagram of dynamic braking circuits on Alco-G.E. road locomotives.

cuit during braking. It provides a differential effect which requires the exciter to work at a higher level of excitation. The voltage drop across the generator commutating field is used to measure motor field excitation by means of coil *D1-D2* on reactor *X1*.

An amplidyne exciter *E* feeds the generator shunt field *GS-GSS*. The generator field current flows through coil *D3-D4* on reactor *X3*, which measures generator field current. To permit a simple adjustment of the effect of the current in this reactor coil, proportional current from the exciter is fed into the *D2-D1* coil on the *X3* reactor.

The exciter shunt field *F1-F2* is fed from the transformer *T1* through the rectifier *R1*. The exciter field current is controlled by having the reactor feed into resistance *152* whose voltage may range from a few volts below that supplied by the rectifier to a few volts above it. The difference is available to control current flow through the exciter field in one direction or the other. At the right is the braking potentiometer with its brush arm in the minimum braking position, i.e. as it is immediately after setting up the braking circuits. This allows maximum current to flow through the *165* resistor and the *D3-D4* coil on *X1* to the other side of the 75 volt d.c. supply. This gives maximum battery bias on *X1* and no bias on *X2*, which is shorted out. Reactor pairs *X1-X2* and *X3-X4*, arranged as voltage pairs, are connected across another secondary of transformer *T1*. With constant voltage applied to each pair, saturation of either reactor in the pair by means of direct current will increase the voltage across its mate. Saturation of *X1* will increase the voltage across *X2*. This voltage, rectified by R3 appears as a higher voltage on resistance 152, reducing the current in the exciter field. In minimum braking, the d.c. bias on *X1* fed by resistor *165* is sufficient to decrease the field current very nearly to zero. We want substantially zero braking when going into braking. This requires zero motor field excitation. With this condition, no current would flow in the *X1* coil *D1-D2*, connected across the generator commutating field. If current did flow, it would further saturate reactor *X1*, and further reduce the exciter field strength. This would decrease the generator excitation and reduce the motor field current.

To sharpen up the control, particularly desirable in minimum braking, the boot strap winding *D5-D6* on X1 is used. This winding, shown immediately above rectifier *R3*, takes the output of reactor pair *X1-X2* and uses it to further excite *X1*. Up to this point, the effect of the three windings on the saturation of *X1* has been additive. The terminal symbols *D1-D2*, etc., are established for each winding so that current flowing from *D1* to *D2* will be additive with current flowing from *D*-odd to *D*-even, in any other coil on the same reactor and, of course, subtractive for reverse polarity.

After the slack has been run in more braking is desired. The engineman moves the braking handle so that the potentiometer brush arm turns toward the maximum braking position, and provides a voltage of increasing value. This increases excitation on *X-2* reactor, which has only one d.c. coil. Thus, more excitation is required on *X1* to return to the same value of voltage across *X2*. At the same time, the range is still further extended by decreasing the additive current in the *D3-D4* winding, and finally reversing it as the brush arm reaches a potential above that of the mid point of the *165-165A* voltage divider.

The incremental transient decrease of the voltage across the *152* resistance allows more exciter field current to flow. This in turn, causes more motor field current to flow, producing more drop across the generator commutating field. As a result more current flows through the *D1-D2* winding of *X1*. This winding thus controls the exciter field current at points above minimum braking, with the values controlled being preset by the braking potentiometer brush arm voltage. The current in this winding is determined by generator excitation and is controlling the exciter field current. Hence, for a given braking handle position, a balance point is reached where the current in the commutating field allows just enough exciter field current to flow to maintain the gen-

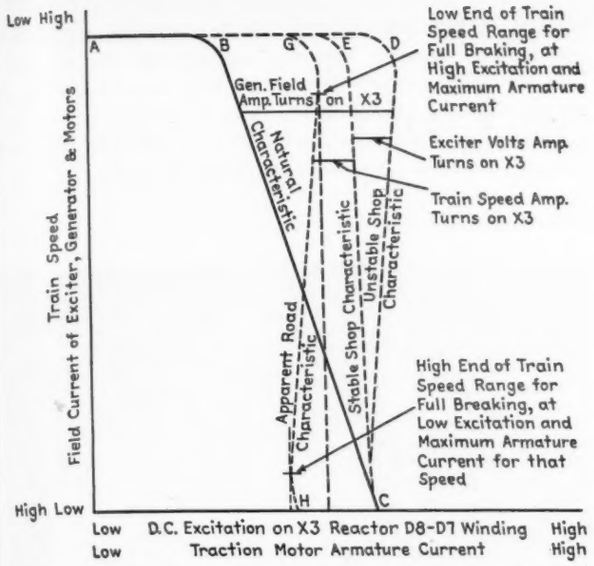

Low High
A
B
G
E
D
Low End of Train Speed Range for Full Braking, at High Excitation and Maximum Armature Current
Gen. Field Amp. Turns on X3
Exciter Volts Amp. Turns on X3
Train Speed Amp. Turns on X3
Natural Characteristic
Unstable Shop Characteristic
Stable Shop Characteristic
Apparent Road Characteristic
High End of Train Speed Range for Full Breaking, at Low Excitation and Maximum Armature Current for that Speed
H
C
Train Speed
Field Current of Exciter, Generator & Motors
High Low
Low D.C. Excitation on X3 Reactor D8-D7 Winding High
Low Traction Motor Armature Current High

Fig. 7—Controlled braking characteristics. Entire characteristics may be shifted to the left or right by changing X4 D1-D2 ampere turns.

erator current. Any decrease in generator current allows more exciter field current to flow, and any increase reduces the exciter field strength.

In this way, the *X1-X2* reactor pair provides the engineman with control of braking current as long as he does not try to exceed a preset limit. He controls the leading unit directly and, with the same potentiometer the other units through a train wire.

Automatic Current Limit

Until recently, the above description covered the entire system of dynamic braking control on Alco-G. E. locomotives. Now, however, a current limit based on traction motor armature current has been introduced. This provides an overriding control of braking, present and automatically regulated. With it the engineman can control dynamic braking with much greater ease, since he need not watch his ammeter or brake warning light so closely. It protects the equipment by preventing accidental or deliberate overloads. It provides a better balance of braking between coupled units, because it goes deeper into the system to take a measurement of output. Instead of motor field current, it measures motor line current. This substantially eliminates the effects of varying motor characteristics and wheel sizes between units. Of course, it does not eliminate these factors between motors of the same unit. As applied to Alco-G. E. road locomotives, this refinement allows greater braking at low train speeds than at high speeds. It does this by taking advantage of the lower core loss at low speeds, allowing more copper loss for the same motor heating. To do this with ordinary engineman control of dynamic braking would be very difficult. It would require complex operating instructions which would probably prove most confusing to the engineman.

In Fig. 6, we see a winding *D8-D7* of reactor *X3* connected across part of the braking resistor for motor *3*. This winding measures the braking current in motor *3*, and controls the voltage across resistor *152* whenever the voltage across *X4* exceeds that across *X2*. The generator field current in braking also flows through the *D3-D4* coil on *X3*. The *D8-D7* winding is connected subtractively to obtain a close regulation of motor current throughout the speed range for full braking. Figure 7 shows how the proper characteristic is obtained. The flat section *AB* is produced by maximum braking handle position controlling a fixed motor field current. It is obtained at train speeds below that at which motor *3* generates enough voltage to sufficiently excite *X3* so that the voltage across *X4* will exceed *X2*, as described above. Beyond *B*, the curve turns down to zero excitation at *C*. This is marked natural characteristic and shows the slope of response which must be followed by net ampere turns in *X3* to produce the values of exciter field current shown by the ordinate. All parts of the curve are intended to show the excitation on *X3* given by winding *D8-D7* only. Thus it shows the excitation provided *X3* by the *D8-D7* winding which must be diminished by that from the *D3-D4* winding to return to the natural characteristic. The excitation on *D3-D4* is large at high exciter field currents and disappears at low exciter field currents.

The curve just discussed is unstable on the road because less output of motor *3* would result in more excitation on the exciter and vice versa. So an additional winding on *X3*, properly adjusted and connected across the exciter armature, is used to decrease the effect of the *D3-D4* winding without working with heavy current, low voltage windings of a fixed number of turns. This restores the characteristic to that marked stable shop characteristic. It is the curve sought in standstill adjustment of the system where battery voltage, through a suitable rheostat and instrument, is used to simulate motor *3* voltage.

All recent Alco-G.E. road type locomotives with dynamic braking have been equipped with a recalibrating winding on *X3*. Since this is fed from the locomotive axle generator through a rectifier, it receives a d.c. signal proportional to train speed. The result is to recalibrate the system so that less motor current will flow at high speeds than at low speeds. Thus, advantage is taken of the reduced core loss at low speeds. This produces the curve marked apparent road characteristic. Although it has a negative slope, it is not unstable because an outside element—train speed—controls the slope. Actually, this curve is simply the stable shop characteristic cut back varying amounts at various train speeds. Any transient changes follow the slope of the stable shop characteristic.

This method of automatically controlling maximum braking current provides regulation without using any moving parts except the setup devices. The unstable shop characteristics, Fig. 7, is actually stable in the shop, if a separate source of power is used for the *D8-D7* winding on *X3* is used, but would be unstable on the road. If an incorrect adjustment or other defect produces this sort of characteristic on the road, the effect of the connection of the *D7-D8* winding across a portion of braking resistor which is in series with the blower motor results in minimum hunting. The motor tends to hold the voltage constant across its section of resistance. This makes any transient change in voltage appear almost wholly across the section of resistance adjacent, thereby giving a leading signal to the *D8-D7* coil on reactor *X3*.

The popularity of dynamic braking on diesel-electric locomotives indicates its desirability and acceptance by the railroads. This is based upon its economic advan-

tages, proved by years of operating experience. Furthermore, these advantages are obtained by the addition of very little equipment not required for traction purposes, so that the capital investment is relatively insignificant. Progress in the design of dynamic braking system has further enhanced the advantages. The refined system described in this paper automatically provides maximum permissible braking capacity throughout the locomotive operating range. It permits this brake to be used advantageously on almost any railroad profile, and makes additional braking power available at lower speeds where it is of particular advantage in freight service.

(Above, left) An interpole field coil receiving a half-lap wrap of silicone-treated glass tape

(Above, right) The fourth wrap puts a layer of silastic tape over the mica and glass tape and under the outside wrap of silicone-glass tape

Field Coil Insulation

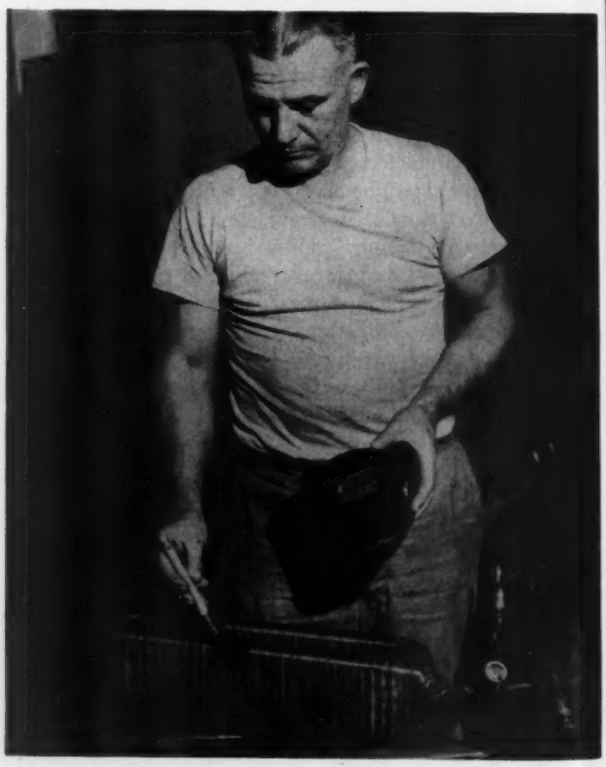
To insure long life and freedom from trouble, the Union Pacific has developed a method of insulating traction motor field coils that employs three kinds of tape and three kinds of varnish.

When a coil is to be reinsulated, the old insulation is first stripped to the copper. The copper is baked eight hours at 300 deg. F., and the filler between the large and small sections of the main field coil is replaced or renewed. A coating of silicone varnish is brushed on to the copper.

The thickness of the coil is measured and mica strips are laid on top of the coil, to bring the coil assembly to the proper thickness. The coil is then given a half-lap wrap of .010-in. thick silicone-treated glass tape, a second half-lap wrap of .006-in. thick mica and glass tape, a third wrap of the .010 in. silicone-treated glass tape, a fourth wrap of .020-in. silastic tape and fifth wrap of the .010-in. silicone-glass tape.

The coils are then baked for eight hours at 300 deg. F., cooled to room temperature and put through the impregnator. They are then baked four hours at 300 deg. F., given a brush coat of silicone varnish, and baked again for four hours at 300 deg. F.

After the coils have been assembled in the frames the entire assembly is put through the impregnator. The final operation consists of giving the coils a spray coat of red insulating paint.



(Below) Coil receives a brush coat of silicone varnish before final baking

The Effect of Design On Locomotive Maintenance

If you are going to buy a diesel-electric locomotive, here is a list of things to look for which will help to produce trouble-free operation and low maintenance costs

MANY DETAILS of design of electrical apparatus and its installation in the locomotive have a profound effect on the amount and quality of maintenance attention it requires and receives in service. Simplicity and ruggedness are basic.

The influence of design upon diesel-locomotive electrical maintenance cannot be over-emphasized. This applies not only to the design of the electrical apparatus, but also to the design of the conduit and wiring, electrical cabinets, cab structure and even the diesel engine itself.

J. Stair, Jr., electrical engineer, Pennsylvania, was recently asked by the Land Transportation Committee of the American Institute of Electrical Engineers to list the resign factors which most importantly affect diesel-electric locomotive operation and maintenance. He responded with a paper which was presented at the Winter General Meeting of the Institute, which includes the following suggestions and recommendations.

Electrical apparatus must conform to the appropriate standards of the industry, with proper selection and use of traction motors, generators, auxiliaries, control and protective devices, and with some leeway in the capacity of the apparatus with respect to the work to be done. Modern inorganic materials should be used for the insulation of traction motors and generators. A detailed discussion of these items is beyond the scope of this paper.

Dirt, moisture, and oil fumes are inevitable, consequently, an oily conductive film develops on the apparatus. Panels, connections, and interiors of motors and generators must be designed with adequate creepage paths and no portion of the power circuits should be exposed except where adequate creepage paths are provided.

Relays should be enclosed in dust-tight containers, with glass or plastic covers permitting visual inspection of the operation of the relay. Rotating apparatus should be equipped with grease lubricated sealed bearings to exclude foreign matter and extend maintenance periods.

Electrical devices suitable for railway service should be used throughout. Bearings and contacts of industrial-type devices, such as relays, contactors, and instruments often will not stand up under the shocks of running over the road and the vibration of the diesel engines.

Protective and control devices should be inherently sealed to prevent tinkering by crews and others who too often are more interested in experimenting with the various items of apparatus than with proper operation.

All electrical apparatus and wiring should be designed to permit pressure spray cleaning of the interior and exterior of the locomotive without water or cleaning agents entering the electrical apparatus or wiring.

Conduit and Wiring

Conduit, wire and cable troughs, and wiring within the engine room should be located overhead or on the side walls well up from the floor and above the air intake filters.

Conduit should be of ample size to permit pulling in additional wires if required in the future, and to permit freely pulling out the original wiring for repairs or renewal.

Insulation on all wires and cables should be of heat-resistant material with fire-resistant non-absorbent neoprene exterior.

All conduit, fittings and junction boxes should be absolutely waterproof to permit pressure spray cleaning.

Cables cleated to the underside of the cab structure should be out of the way of, or protected from, brake shoe sparks, and should be clear of wheel wash and of any location subject to seepage of oil or water from the engine room. They must also be protected from direct impact of jets from running-gear, high-pressure cleaning devices. Cables and cable protection should not form pockets which will catch leaves, paper or other combustible material.

Connections between motor leads and cab-structure leads should be easily disconnected, reconnected and reinsulated. Leads must be sufficiently flexible to avoid breakage, and so cleated, located, and protected as to eliminate chafing.

To facilitate the replacement of cables under the cab structure, the bolts which secure the cleats to the underside of the cab structure should be attached firmly to the cab structure.

Sharp corners in conduit and cabinets, which may damage wire and cable, should be eliminated, or the wire and cable given special protection at such points.

Electrical Cabinets

Electrical cabinets should be a minimum of 4 in. above the floor to permit mopping the floor, and all wiring should be kept several in. above the bottom of the cabinets.

Doors should be dust-tight and waterproof to prevent entry of road dust, dirt and cleaning solutions.

All wires and cables should enter and leave cabinets in conduit or in wiring troughs. These should be so designed that the entry of dirt or water will be reduced to a minimum, and fires originating on the running gear cannot spread to the cabinets.

Engine room floors should be oil and water-tight to prevent seepage of oil and water onto the traction motors and the cables below the floor.

All openings through floors for pipes, conduits, cables, and drains should be sealed against leakage or provided with raised dams around the opening; they should have suitable barriers to prevent a fire, which might originate on the running gear, from spreading to the interior of the unit.

Cab air filters should be provided to clean all air entering the engine room to prevent ingress of dirt, and to minimize the entry of snow and rain as well. Cab end doors should be automatically self-closing, not readily susceptible to being blocked open.

All doors and windows should be as dust-tight as practicable.

Adequate quantities of clean cooling air to main generators, traction motors and electrical cabinets must be provided.

To keep oil fumes out of the electrical apparatus, cooling air streams should not previously pass over the diesel engine and its appurtenances.

Suitable sumps should be provided beneath diesel engines and air compressors to catch and drain off all leakage of oil and water.

Diesel engines

Diesel engines should be designed and constructed to provide the absolute minimum of oil leakage from top deck covers, inspection covers, crankcase breathers, piping, frame joints, etc.

Exhaust manifolds and all their connections must be absolutely free of leaks to avoid the entry of exhaust fumes and soot into the engines rooms and thence to the electrical apparatus.

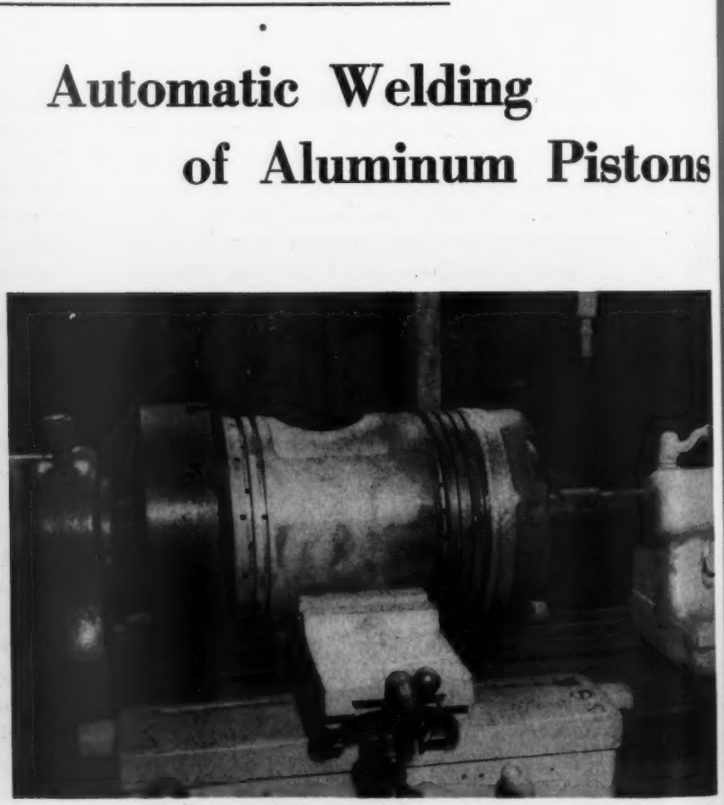
The diesel locomotive is a complicated piece of machinery. Unlike a stationary power plant or the machinery of a ship, it must, on a large railroad be operated and maintained continually by many different persons.

In the interests of reliability and economical maintenance, simplicity of design and ruggedness of apparatus are of fundamental importance. Rugged does not necessarily mean massive. Although efficiency is to be desired, refinements to attain it to a high degree are not warranted if they result in complications of maintenance and in falures.

To facilitate both operation and maintenance, standardization of apparatus is desirable. Therefore, a modification in the design of a piece is to be avoided, unless it sufficiently improves the operation or benefits the maintenance.

Likewise, in a given type of locomotive, both operation and maintenance are facilitated by standardization of the location of the various pieces of apparatus in the operating cab and in the engine room.

Automatic Welding of Aluminum Pistons



Left: During preheating and welding, the piston is covered by an asbestos-insulated metal guard. Above: An aluminum piston in the lathe after the welding of two ring grooves.

The Southern Pacific is now using the Aircomatic welding process for the reclaiming of aluminum diesel locomotive engine pistons. The process consists of using an automatic or semi-automatic gun to feed an aluminum electrode into an electric arc supplied by a d.c. welding machine, the arc being shielded by an inert gas. In this application, the gas is helium.

For the welding of ring grooves, the piston is rotated in the lathe at a speed of 18 to 24 in. per min. A gas flame inside the piston is used to bring the piston to 300 to 400 deg. F., and to maintain that temperature during

The welding rod and gas are fed from a reel and tank at the right, over the operator to the welding head. The d.c. electric welding set is behind him

the welding operation. The temperature is determined by the use of Tempelsticks. Gas for the flame inside the piston is supplied by a pipe which is run through the lathe spindle.

An automatic welding head maintains the correct arc length and feeds the aluminum rod into the arc. At the same time a tube through which the rod is fed, carries helium which forms an inert protective shield around the arc.

Depending upon the width of the groove, each groove is filled with five to seven passes or turns of the piston. The voltage used is about 28 and the wire is positive. The current is held at approximately 180 amp. The 43-S aluminum rod used is $\frac{1}{16}$ in. in diameter, and the rate of feed is 195 in. per min. The amount of helium required is about 90 cu. ft. per hr. The time required to preheat a piston is about 30 min.

For the welding of keyways or cracks, the welding head is operated manually with automatic feeding of the rod. After welding, the piston is cooled in an asbestos-insulated box in which it is allowed to remain over night. The welded pistons are subsequently remachined.

During the welding operation, the piston is rotated away from the operator to reduce welding spatter.

The same lathe is used to prepare the pistons for welding. This consists of removing $\frac{1}{64}$ in. or more of metal from each side of the ring groove and of cleaning the bottom of the groove.

Replacing Damaged Covers Extends Useful Life of Battery

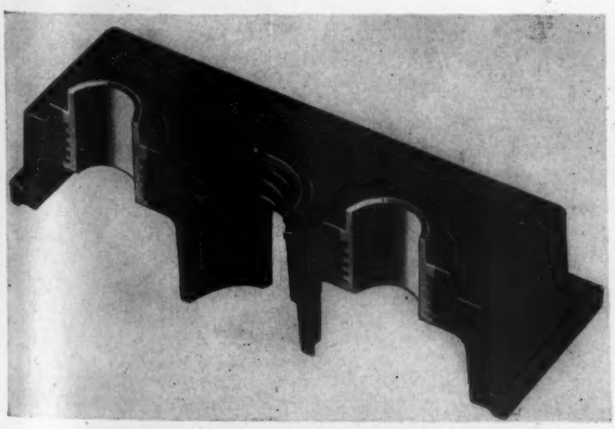


Fig. 1—A cutaway view of an industrial battery cover showing how the lead inserts are molded integrally with the hard rubber.

To EXTEND the life of an industrial truck storage battery which has been damaged accidentally, it is often necessary to remove its cover for cell replacement or element repair. Though simple, the procedure is not widely understood, and the following instructions are offered by the Service Department of the Gould-National Batteries, Inc.

Because the covers of rubber-jar batteries have post openings which are lined with lead inserts integral with the hard rubber cover, see Fig. 1, and because these lead inserts or linings are welded to the lead battery posts to prevent leaks, it is necessary to drill out gaps between posts and inserts in order to remove a damaged cover.

A special drill has been devised by Gould-National

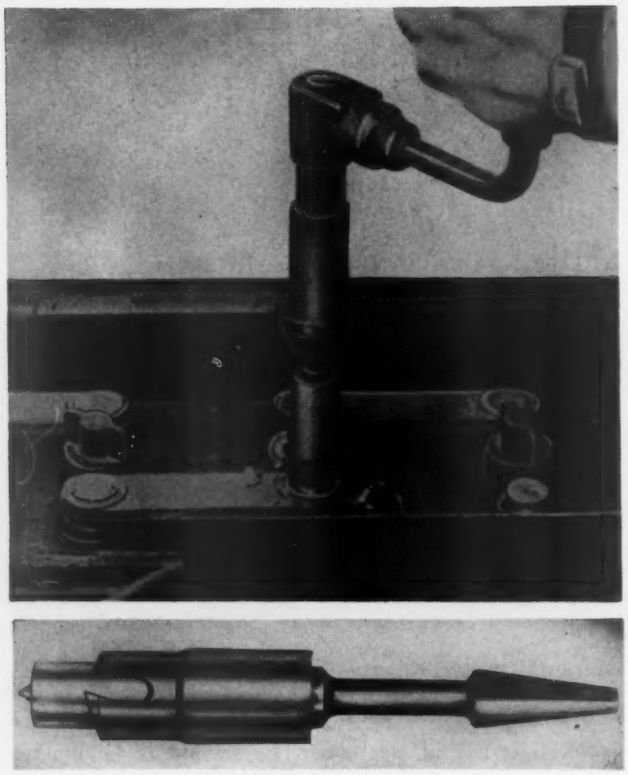


Fig. 2—Drilling an annular hole with the special tool shown in the lower picture. This tool permits cell connectors and jar covers to be removed without disturbing the terminal post.

Fig. 3 (Lower left)—An alternate method of drilling posts to permit removal of a damaged cover involves the use of a 15/16-in. drill.

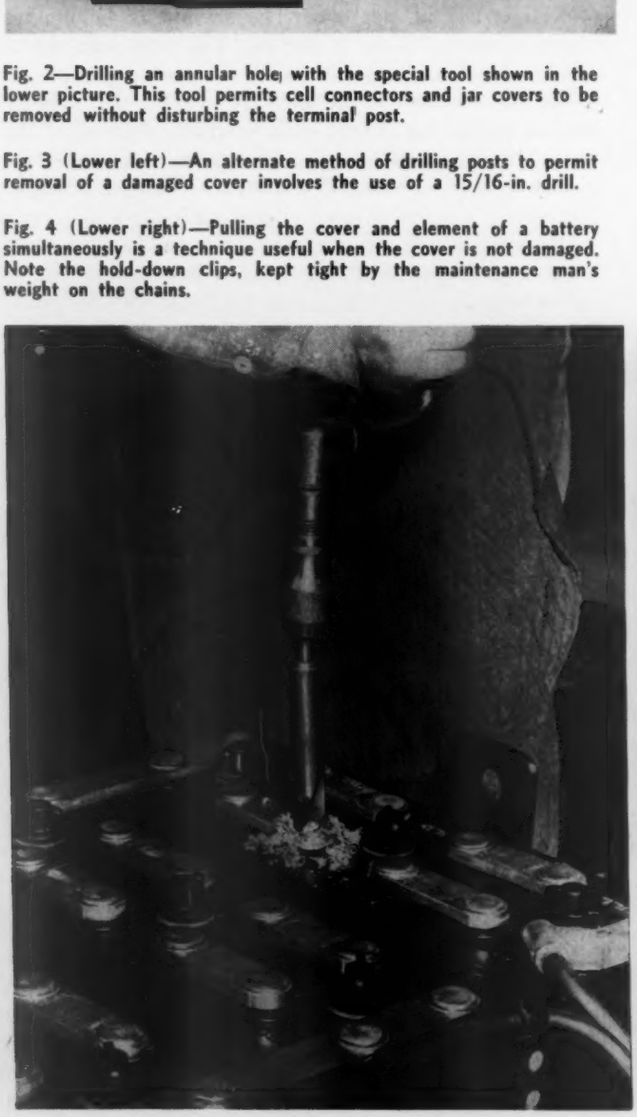
Fig. 4 (Lower right)—Pulling the cover and element of a battery simultaneously is a technique useful when the cover is not damaged. Note the hold-down clips, kept tight by the maintenance man's weight on the chains.

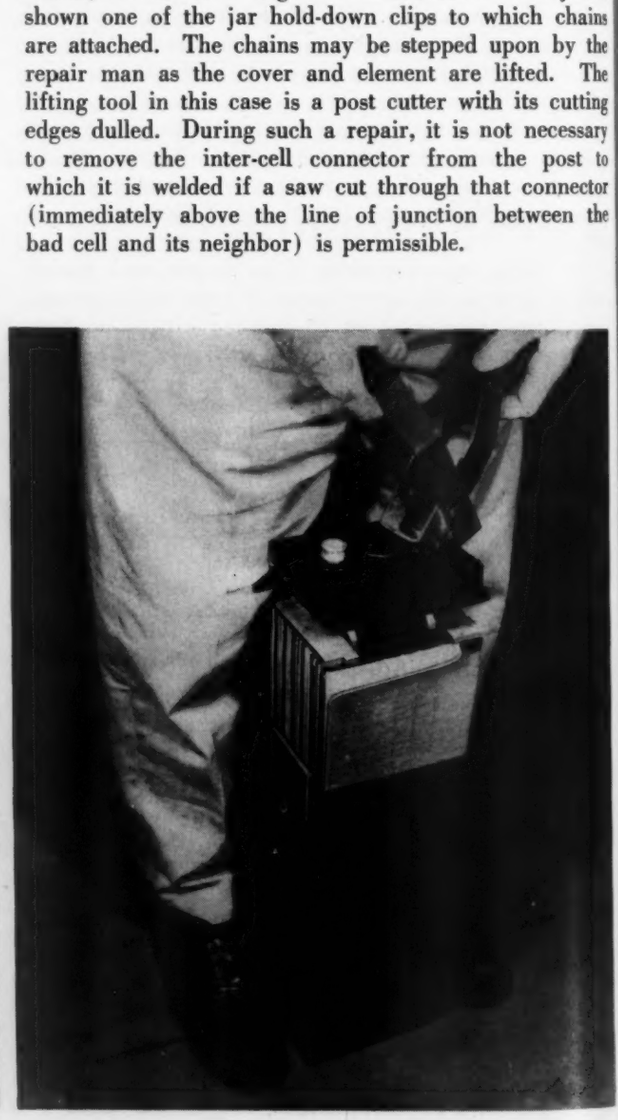
engineers (obtainable as repair tool No. 35459C) which cuts an annular hole, as shown in Fig. 2, and permits the lead posts to remain solid, upright and of normal height after the cell connector and the jar cover have been separated.

The other technique is to drill the posts in the damaged cover to a depth of $\frac{3}{8}$ in. using a $\frac{15}{16}$-in. drill, as in Fig. 3. This frees the inter-cell connector. Such drilling may then be continued through the cover to free it in turn. This latter technique requires rebuilding the posts before reassembly in a new cover to replace the broken one. Such rebuilding is done by a lead puddling, applying heat by a carbon electrode manipulated within the cavity of a simple post mold. Post molds are available as purchased items if the maintenance man does not care to make his own (Gould-National maintenance tool No. T-77013).

In the case of certain battery designs there is sufficient clearance between the inter-cell connector and the top of the cover so that the first drilling may be eliminated by a horizontal saw cut under the connector.

In cases where the cover is not damaged, but both cover and elements are to be withdrawn from the jar for basic cell repair, it is only necessary to remove the inter-cell connector and lift both cover and elements as a unit, as shown in Fig. 4. At the left of the jar is shown one of the jar hold-down clips to which chains are attached. The chains may be stepped upon by the repair man as the cover and element are lifted. The lifting tool in this case is a post cutter with its cutting edges dulled. During such a repair, it is not necessary to remove the inter-cell connector from the post to which it is welded if a saw cut through that connector (immediately above the line of junction between the bad cell and its neighbor) is permissible.





EDITORIALS

Diesel Shop Problems

A recent extensive, but by no means all-inclusive, list of problems confronting dieself shop supervisors disclosed some interesting facts as well as many questions about maintenance practices which need authoritative answers. These questions were just about evenly divided between electrical and mechanical, the former including such pertinent inquiries as how to rewire high and low-voltage circuits to reduce the possibility of grounds, how to clean wiring and electrical equipment without damaging it, test and repair of wheel-slip control devices, extend traction motor life between general overhauls and especially prolong brush life, check sequence and interlock troubles, forestall motor armature bearing failures, test individual control parts, assure greater protection against foreign matter such as dirt, oil, fumes and moisture getting into main generators, auxiliary equipment and control panels.

An imposing list of questions about mechanical details of diesel locomotives included how to get greater life from main and connecting rod bearings, prevent excessive oil leakage, especially between crankcase and oil pan, control water leaks, check crankcase for alignment during general repairs, assure equal loading of all cylinders, prevent valve failures in service, schedule periodic repairs for all engine parts so as to avoid complete dismantling except in case of serious structural frame failure, extend the permissible wear of all friction bearing parts to the maximum safe working limit, maintain oil and air-filter conditions so as to keep all possible dirt out of critical engine parts and accessories.

Questions about shop planning related to scheduling materials needed for heavy diesel repairs, assigning types of work and various crafts to the different shop departments, setting up class repairs for diesel units of all types, laying out an effective diesel truck repair shop, coordinating diesel and steam locomotive repair work where both are handled at the same shop point, determining the feasibility of production replacement of diesel engine parts, especially in small shops, providing tools of improved design where needed, and periodically checking to make sure they are kept in condition to maintain desired standards of accuracy in diesel maintenance work.

Other suggestions included time studies of repairs to diesel units, cost control through job standardization, simplification of diesel maintenance records, scheduling of inspection periods, determination of the relative advantages of dropping entire trucks versus one pair of wheels and the traction motor, improved inspection and maintenance of diesel wheels, axles and roller bearings, setting up better crankshaft and crankcase reconditioning methods and establishing optimum crankshaft life.

Entirely aside from questions about materials and shop maintenance methods, more inquiries were made about various phases of diesel personnel training than any other one subject. This is as it should be for in the last analysis, the best materials, tools and methods in the world are of no avail without men who know how to use them.

Who Is at Fault When Policy Is Wrong?

There exists a pretty fair sized group of car men who contend that equipment failures on the road could be reduced substantially if more time were allotted to mechanical servicing before the train left the yard. Generally speaking, this group feels that the comparatively small additional amount of time spent putting the train in top shape while in the yard would be saved several times over by the reduction in car-hours and train-hours lost from road failures.

Unfortunately facts and figures are lacking to support this contention, or to refute it for that matter. Thus the subject must be discussed in the abstract. Groups with diverse views on the subject will probably agree that there are some yards on some roads where more time could profitably be devoted to servicing, but that there are other yards on these same and other roads where enough time is allowed. The proportion of yards that fall in either category would be subject to as many guesses as there would be people who were doing the guessing.

The most interesting, and perhaps the most important, aspect of the controversy is just what is being done by those who strongly believe that more servicing time will reduce delays by more than the additional amount of service time spent. It is interesting because it points out an important factor frequently lacking at the departmental level—a factor which has been given the emphasis it deserves in several recent talks by high railroad officers. That factor which is so often missing is the ability to sell, not goods or services in this case, but ideas.

Any idea is of practical use only when sold to the person with the authority to carry it out. This can be done by gathering and organizing the necessary facts and figures to support the contention. In this case, how much more time on what size trains? What specific examples can be cited where reasonable evidence exists that longer service time would have prevented a road delay? Over a specific period of weeks or months, how does the time lost from preventable road delays compare with the total additional time would have been lost had more time been devoted to servicing? These and other *facts*, not guesses or general appraisals, must be presented to management in terms of overall management interest and in words they can understand.

When management fails to accept an idea which we consider sound, we are all too prone to place the blame for this lack of acceptance on the top brass being un-

progressive. The fault is more apt to lie in the manner of presentation of the idea—insufficient facts, lack of evidence to prove they are facts, inaccurate figures, poor organization of argument, and the use of technical departmental lingo not clear to a man brought up in another department.

What It Takes To Keep Diesels Rolling

No one anticipated the rate at which diesel-electric locomotives would be placed in service in this country. They have been absorbed without as much difficulty as might reasonably be expected and they have done much for the railroads. By and large, maintenance facilities have kept pace with the introduction of the locomotives. At least it could have been worse. One country, supplied with funds by the United States, used a part of the money to buy diesel locomotives. The brightly-painted units were evidence to the populace that something was being done for them. Unfortunately, maintenance facilities are without glamor, and it was felt that money could not be expended for them. So only locomotives were purchased, with the result that many of them failed after being in service only a short time. Then, under the rules, there was nothing to do but buy more locomotives.

For successful operation, it is necessary to have, first, locomotives; second, spare parts; third, maintenance facilities, and fourth, know-how. In this country, spare parts are, for the most part easily available. Maintenance facilities have been developed both by the railroads and the manufacturers. To provide the know-how, there are instruction books and bulletins, schools operated both by the railroads and the builders and instruction cars equipped with locomotive parts and manned by instructors who travel with the cars. There are also diesel clubs, apprentice programs and the technical press.

Since July 1951, *Railway Locomotives and Cars* has been publishing a series of articles called Diesel-Electrics —How to Keep 'Em Rolling. The material in these articles is fundamental to all locomotives and has found much favor among locomotive maintainers. The first ten articles are available in pamphlet form, and when the series is finished, it will probably be put out as a book.

Up to now, these easily understood articles have been prepared almost entirley without the use of wiring diagrams. Such diagrams were not necessary, and it was felt that they should not be introduced until a greater part of the maintainers were conditioned for them. Of course, the ability to read and understand a wiring diagram is a must for those who do electrical maintenance work on diesel locomotives and the number of men who can do it well is still insufficient.

The subject of wiring was approached in the December 1952 issue in the explanation of static control devices. It was continued in January in the introduction of some simple battery circuits. This issue dose not contain one of the maintenance series articles. Instead there is an article on dynamic braking on dieself-electric locomotives. In it there are wiring diagrams, which are not difficult to follow, but they cover a form of locomotive control which has been considered to be complicated. Almost any maintainer who can read a road map, can follow these diagrams if he gives them close attention. Having done it, he need not be afraid of what may come.

There will be few wiring diagrams in future articles in the series. It is not intended that they be specific, for wiring diagrams, like locomotive models go out of date. But having become familiar with the principles involved, it is a small step to the understanding of things which are only a little different from each other.

NEW BOOKS

POCKET MANUAL OF ARC WELDING. *Compiled and edited by Lew Gilbert, editor, Industry and Welding. Published by The Industrial Book Co., 1240 Ontario street, Cleveland 13, Ohio. 172 pages, 5 in. by 7¾ in. illustrated, soft canvas cover. Price $1.25.*

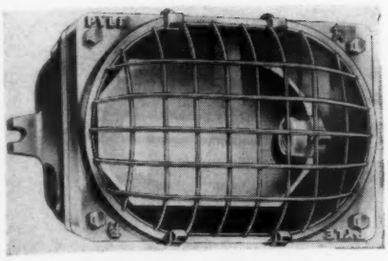
A handy, pocket-sized reference book for welding supervisors, inspectors and management personnel, this book contains specialized data for those people who have felt a need for a quick and concise guide to the many phases of arc welding which they encounter each day.

The 22 chapters of the book feature "how-to" information on welding of mild, alloy and stainless steels. as well as hard surfacing and welding of other ferrous metals. "Causes and Cures of Common Welding Troubles", "Welding Symbols and How They Are Used", "Simple Qualification Tests for Operators" and "Types of Joints and Typical Welding Positions" are some of the chapter titles. Included in the illustrated book are valuable comparative charts which list the various types of arc welding electrodes by AWS classification and comparable electrodes made by various manufacturers.

METADYNE STATICS. *By Joseph Maximus Pestarini. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 415 pages, 6 in. by 9 in., illustrated. Cloth bound. Price, $9.00.*

Periodically, *Railway Locomotives and Cars* receives requests to publish articles on the metadyne. For those who really want to know what it is, how it works and how it is used, this book provides the answers. Metadynes may, without too great liberty, be classified as electromechanical vacuum tubes. Forms of the metadyne are used in diesel-electric locomotive control and it has been used in special ways on electric locomotives. A working knowledge of mathematics is necessary to a complete understanding of the book. Chapters in the first part of the book include the following titles: Canonical Currents; Electromotive Force Induced in an Isotropic Metadyne; Main Characteristics of an Isotropic Metadyne; The Metadyne With Substantially Variable Speed; Metadynes Complete With Their External Connections; Quasi-Static Characteristics and Static Stability; Consideration of the Anisotropic Metadyne and of the Saturated Iron; On Commutation. The second part of the book describes specific types of metadynes. The author is a lecturer at the Massachusetts Institute of Technology and Columbia University.

NEW DEVICES



Pit and Subway Floodlights

The Pyle-National Company, Chicago 51, has introduced a rectangular vaporproof floodlight, designated Type 1570 Pit and Subway Light. It is designed for recessed or surface mounting in the walls or ceilings of maintenance pits, underpasses, tunnels, subways, washracks and other locations subject to heavy moisture.

The reflector can be pivoted to adjust the angle of the beam 18 deg. upward or downward from center. The heat and impact resisting front glass is plain, to reduce reflection losses and make cleaning easier. Drainage slots are provided on the cover to avoid standing water. Hinged, heavy wire guards are optional.

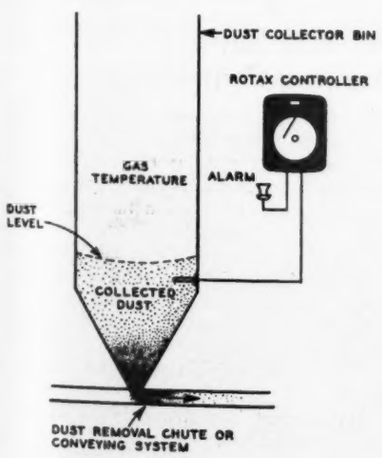
◆

Dust Level Control System

Fly ash being collected in an electrical precipitator can be automatically measured to control its level in a bin or tank. This is performed by a single instrument, the Model 40 Rotax Controller, product of the Foxboro Company, Foxboro, Mass.

A temperature bulb which is mounted in the precipitator senses the higher temperatures of the flue gases from which the dust is precipitated. When deposits of dust cover the bulb, the controller completes an electrical circuit through its contacts to sound an alarm to warn the operator.

The device can also be installed to operate a screw conveyor or other motor-driven equipment to automatically empty the bin or tank when the desired level is reached.



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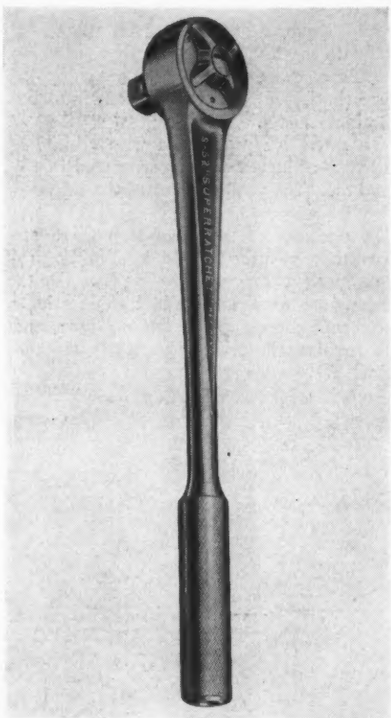


Reversible Ratchet

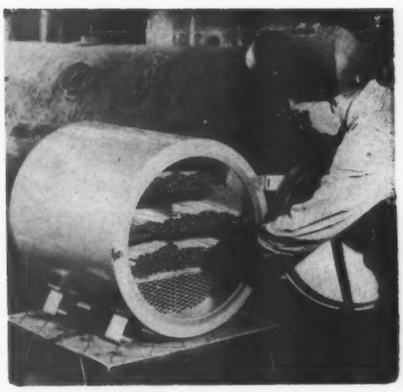
Recently introduced is this, the Model S-52 Superratchet, made of alloy steel which has been heat-treated and chrome plated.

This device, made available by J. H. Williams & Co., Buffalo 7, N. Y., has a concentric type mechanism of 82 tooth action to provide small increments of ratchet action. Design of the "shifter" provides reverse action and one-hand operation. A knurled handle offers the operator a firm grip for rotation of nuts in close quarters.

◆

Welding Electrode Ovens

The General Electric Company's Welding Department is now a national distributor of DryRod Electrode ovens. The ovens, available in two sizes, type 300 (350-lb. capacity) and type 900 (900-lb. capacity),



will be stocked by G.E. welding distributors throughout the country.

The function of the ovens is to eliminate damaging effects of moisture pick-up by welding electrodes and assure better welds. The type 300 oven holds electrodes ranging up to 18 in. in length, while the type 900 can accommodate 24-in. electrodes.

The ovens weigh 115 and 410 lb., respectively, and are constructed of all-welded reinforced sheet metal to withstand rough shop use. Thermostatic controls provide a 175 to 550 deg. F. range, and tests indicate less than a 5-deg. variation throughout the ovens. Removable trays permit conversion of the ovens for other uses.

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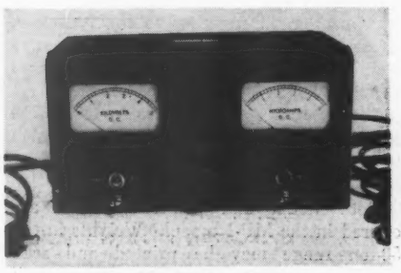

Instrument for High Voltage Tests

A d.c. high voltage dielectric strength testing instrument, Model 424 Hypot has been announced by Associated Research, Inc., 3758 W. Belmont Avenue, Chicago 18. The instrument has a continuously variable voltage output and a means to measure output current.

It is designed for electric insulation tests requiring various potential stresses. It permits calculation of d.c. resistance based on test voltage and output current flow. The ammeter is protected against damage by output short circuit. The a.c. ripple is within one per cent.

Range of the instrument is 0-5000 volts and 0-5-10-50 and 100 microamps. Special

models can be furnished with ranges up to 7,500 volts and 5 microamps and 2 milliamps. The test output terminates consist of a retractable tip high voltage prod and a rubber covered ground clip. The instrument weighs 24 lb. and measures 14 in. by 9 in. by 7½ in.

◆

Freight Car Electronic Scale

Electronic scales for weighing railroad cars and motor trucks have been made available by Cox & Stevens Aircraft Corp., Mineola, N. Y.

Truck platforms are supported by 4 to 6 electronic weighing cells, depending upon capacity. These cells, which are 6 in. high, are hermetically sealed and contain resistance wire strain gage units which transmit weight impulses to the indicator. Track scales normally require 8 such weighing cells of a larger individual capacity.

Truck scale capacities range from 10 to 50 tons. Track scales go up to 400 tons. Standard platform and weighbridge sizes are available in each category.

Both visual and printed weights are offered in the MP-1 model. Weights in the 50-ton range may be printed and read in 5-lb. increments. On 200-ton track scale equipment, weights may be printed to the nearest 50 lb.

◆

Solderless Terminals for Thin Insulation

An easy and accurate means of crimping solderless terminals to wires having extremely thin-walled insulation has been announced by Aircraft-Marine Products, Inc., Harrisburg, Pa.

Deltabeston, Type SI-57360, Neolay and similar wires conforming to Specification MIL-W-5086, have extremely thin insulation sheathing which makes them ideal for

special applications. However, they are difficult to terminate because unless a worker exercises great care, he is apt to force both wire and insulation into the terminal barrel.

To solve this problem, a wire positioner called the Shur-Stop is incorporated in the hand tool. The positioner stops the stripped wire in its proper place.

In addition to the Shur-Stop there are two other positioners which help to produce perfect terminations on the Deltabeston-type wires. A terminal guide orients the terminal correctly in the tool jaws, and the terminal barrel-stop positions the terminal at the proper crimping area.

◆

Pressure Meter

This instrument can measure pressure with an accuracy of one part in 5000 and has a sensitivity of one part in 15,000. Its 600 in. scale, printed on 35 mm. film strip, was developed to take advantage of the instrument's sensing elements. An interval of 1/16 in. on the scale represents 1/10,000 of the full pressure range.

Known as the Press-I-Cell, it was designed by Fischer & Porter Company, Hatboro, Pa. It is said to be portable, temperature-stable, unaffected by vibration or mounting position and is 5 in. in dia. and 14 in. long.

The unit will measure the drop in atmospheric pressure when it is raised about 6 in. above any previous resting position. It can be equipped to operate over wide range of gage pressure or differentials. Typical pressure ranges are 1 atmosphere absolute, 400 in. water column, and 150 in. Hg differential. Either of two models, manual setting or automatic are available.

It can find application as a master laboratory instrument for calibrating other pressure-sensing units; precision measurement of altitude or barometric pressure; a liquid level gage for large storage tanks; etc.

◆

Pipe and Conduit Reamer

This tool, the Rigid Spiral 2-S pipe reamer has been designed to cut inside burrs from pipes and conduits. It can also be utilized to cut holes in sheet metal.

Made by The Ridge Tool Company, Elyria, Ohio, the device has a capacity of ⅛ to 2 in. It is furnished with a ratchet handle. The reamer unit alone may be purchased for use in the ratchet handle of the firm's No. OOR Threader.

◆

Ice and Snow Melting Compound

The product consists of fast-acting chemical pellets which are utilized to eliminate snow shoveling and ice chipping. When sprinkled lightly on slippery surfaces, it spreads itself and starts a thawing action in a matter of seconds.

Containing Speconite rust inhibitor and called Ice Rem, the compound is a formulation of Speco, Inc., Cleveland 9. It is recommended for removing ice and snow on steps, walks, railway switches, etc., and for furnishing quick traction on icy surfaces.

The product is available in 10, 25 and 100 lb. containers.

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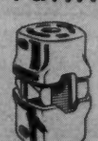
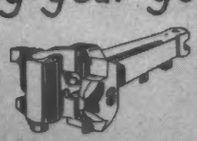
Cast Steel Brake Beams

Ride-Control Trucks

Ride-Control Packages



Simplex Snubbers



Tightlock Couplers

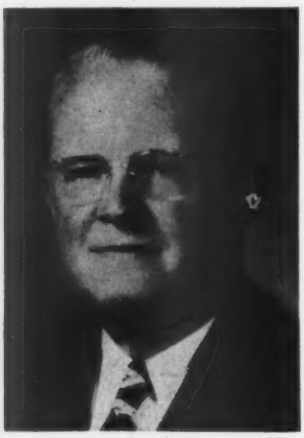
Type F Couplers

Type E Couplers

NEWS

Metzman Becomes Chairman of A.R.C.I.

GUSTAV METZMAN, for many years president, and for the past five months board chairman, of the New York Central, became chairman of the American Railway Car Institute on January 1. Mr. Metzman began his railroad career in 1903 as a copy clerk in the car service department of the Baltimore & Ohio at Baltimore. Thirteen years later Mr. Metzman left the B&O to join the Eastern Railroad Presidents Conference as a transportation supervisor.



Gustav Metzman

For two years—1918 and 1919—he served with the United States Railroad Administration in New York.

On March 16, 1920, Mr. Metzman entered the employ of the New York Central, with which he was associated until his retirement as chairman of the board on January 1. The only interrruption in his service with the NYC was a five-month leave-of-absence in 1942 when he was chief of the Railroad Division, Transportation Corps, U. S. Army, Washington, D. C.

Mr. Metzman was elected president of the Central on September 1, 1944.

2nd Quarter Allotments; Roads Would End Controls

ALLOTMENTS of materials for construction of 9,000 freight cars per month during the second quarter of 1953 have been made by the Defense Production Administration.

The whole second-quarter allotment for railroad equipment is 1,951,961 tons of steel, 77,822,000 lb. of copper and 5,858,000 lb. of aluminum. The 9,000-car monthly rate of new-car production will be the highest ever achieved under the Controlled Materials Plan the D.P.A. announcement said. It added that it is "expected to be all that can be built under existing conditions in the second quarter."

Meanwhile, the National Production Authority has received from its Railroad Industry Advisory Committee a recommendation that all C.M.P. controls on non-defense production be discontinued next June 30 when the Defense Production Act is scheduled to expire. A like recommendation came from N.P.A.'s Locomotive Builders Industry Advisory Committee, which said the controls should be ended before June 30 "if possible."

The recommendations were made at recent meetings of the committees in Washington. It was the view of the railroad committee that the industry would be better off without controls. However, there was some discussion at the meeting of proposals to make some voluntary arrangement with the steel industry, like that in effect between 1946 and 1951.

"Insufficiency of rail was called the industry's most acute problem," according to N.P.A.'s report of the meeting.

At the meeting of the locomotive industry committee, it was stated that allotments for next year's second quarter should give builders materials for 883 units. Eight hundred of these would be for the U. S. railroads, and the balance for industrial use, the military and for export.

N.P.A.'s Freight Car Component Parts Industry Advisory Committee also held a

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of September 1952	Month of September 1951	9 months ended with September 1952	9 months ended with September 1951
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	17,165	22,960	154,772	227,940
3-06	Total, Diesel-electric	28,300	23,551	242,083	198,738
3-07	Total, electric	763	770	6,799	7,309
3-04	Total, locomotive-miles	46,288	47,281	403,925	434,009
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,748	1,731	14,663	15,452
4-06	Empty, total	882	900	7,976	7,853
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	31,482	42,788	273,985	398,243
6-02	Total in oil-burning steam locomotive trains	8,943	11,321	74,469	108,340
6-03	Total in Diesel-electric locomotive trains	80,691	66,476	671,492	555,595
6-04	Total in electric locomotive trains	2,072	2,152	18,862	20,027
6-06	Total in all trains	123,389	122,744	1,039,791	1,082,323
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.04	1.04	1.03	1.04
10-02	Loaded freight car-miles	41.50	40.60	39.80	39.50
10-03	Empty freight car-miles	20.90	21.10	21.60	20.10
10-04	Total freight car-miles (excluding caboose)	62.40	61.70	61.40	59.60
10-05	Gross ton-miles (excluding locomotive and tender)	2,927	2,878	2,819	2,770
10-06	Net ton-miles	1,381	1,363	1,298	1,299
12	Net ton-miles per loaded car-mile (M-211)	33.30	33.60	32.70	32.90
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	66.50	65.80	64.80	66.30
14	Averages per train hour (M-211):				
14-01	Train miles	17.30	17.10	17.60	16.90
14-02	Gross ton-miles (excluding locomotive and tender)	49,847	48,492	48,941	46,292
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	47.00	47.30	44.60	46.00
14-02	All	44.60	45.00	42.30	43.80
15	Average net ton-miles per freight car-day (M-240):	986	994	895	955
17	Per cent of home cars of total freight cars on the line (M-240)	39.70	37.70	43.70	37.20

PASSENGER SERVICE (DATA FROM I. C. C. M-213)

3	Road motive-power miles (000):				
3-05	Steam	5,750	8,730	62,352	92,496
3-06	Diesel-electric	18,755	16,801	166,827	145,681
3-07	Electric	1,562	1,577	14,603	14,571
3-04	Total	26,067	27,108	243,790	252,748
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	160,855	270,056	2,438,292	2,462,736
4-09	Total in coal-burning steam locomotive trains	29,812	45,894	321,197	484,802
4-10	Total in oil-burning steam locomotive trains	22,981	30,437	232,284	298,249
4-11	Total in Diesel-electric locomotive trains	190,905	176,224	1,723,284	1,524,001
12	Total car-miles per train-miles	9.73	9.77	9.78	9.59

YARD SERVICE (DATA FROM I.C.C. M-215)

1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	780	1,053	7,241	10,947
1-02	Steam, oil-burning	167	221	1,489	2,136
1-03	Diesel-electric[1]	3,268	2,952	28,026	26,293
1-06	Total	4,240	4,250	36,968	39,606
2	Passenger yard switching hours (000):				
1-01	Steam, coal-burning	23	37	251	421
2-02	Steam, oil-burning	10	12	97	116
2-03	Diesel-electric[1]	249	239	2,295	2,172
2-06	Total	314	321	2,942	3,010
3	Hours per yard locomotive-day:				
3-01	Steam	7.50	7.30	6.90	7.80
3-02	Diesel-electric	16.50	16.90	16.10	17.20
3-05	Serviceable	14.90	14.20	14.20	14.40
3-06	All locomotives (serviceable, unserviceable and stored)	13.00	12.20	12.30	12.40
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.69	1.70	1.75	1.77
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.75	0.74	0.75	0.76

[1]Excludes B and training A units.

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Magnus Safety Valve for Diesel Locomotive Steam Generators

- **GREATER ACCURACY**
- **LONGER LIFE**
- **NO STEAM LEAKAGE**

Magnus Fig. 391 Safety Valve

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recent meeting at which committee members recommended what the N.P.A. report called "orderly abandonment" of controls—except as to materials for the armed services and defense-supporting programs. Meanwhile, this committee would have the railroad industry enter voluntary supply arrangements with the steel industry.

N.P.A. officials attending this meeting were reported to have said that steps were being taken "to encourage a flood of new orders." They estimated that "orders for about 240,000 new freight cars will materialize in the next 24 months."

Production of new freight cars "is expected to rise during the first half of 1953, approaching 9,000 per month by June," according to the eighth quarterly report of Henry H. Fowler, director, Office Defense Mobilization.

Mr. Fowler made this prediction after having recalled that the freight-car program "was aimed in early 1951 at 10,000 per month." The failure to approach that goal was due to "insufficient supplies of steel of needed types," Mr. Fowler also said. And he went on to note that "only 96,000 cars were built in 1951 and 75,000 in 1952."

1953 Coordinated Committee Officers

THE 1953 officers of the Committee of the Coordinated Associations are: J. P. Morris, chairman, general manager, mechanical department, AT&SF, Chicago; F. K. Michell, manager equipment, NYC, New York; J. L. Robson, general superintendent, motive power, GN, St. Paul, Minn.; C. F. Weil, secretary, C & D Batteries, Inc., C. & H. Chemical Co., Chicago.

The member associations of the Coordinated Associations group are the Air Brake Association, Car Department Officers Association, Locomotive Maintenance Officers Association, Master Boiler Makers Association, Railway Fuel & Traveling Engineers Association and Electrical Section, Engineering and Mechanical Divisions, Association of American Railroads.

Mech. Div. Scholarship at Stevens Institute

THE Mechanical Division of the Association of American Railroads is offering a special scholarship in mechanical engineering at the Stevens Institute of Technology, Hoboken, N. J., to sons of members of the division. The scholarship, established in 1891, has a value of $1,200 and will be available in September.

The single engineering course offered by the Stevens Institute leads to the degree of mechanical engineer. It includes instruction in the fundamentals of electrical, civil and chemical engineering and management. Candidates for the scholarship, applications for which close May 31, must have completed four years of high-school mathematics, one year each of physics and chemistry, and rank in the top fifth of their graduating classes. Applications can be had by writing to Fred Peronto, secretary of the Mechanical Division, 59 East Van Buren Street, Chicago 5.

Dr. Lomonossoff Dies

DR. GEORGE V. LOMONOSSOFF died on November 19 in Montreal. He had been residing in Canada since 1948.

Dr. Lomonossoff, a graduate of the St. Petersburg Institute of Transport in 1898, served as assistant chief mechanical engineer of the Ekaterina Railway; as president of the Locomotive Experiment Bureau, and as chief mechanical engineer of the Tashkent Railway and, later, of the Nicolas Railway. In 1912 he was appointed assistant director general of the Russian Railways. In 1913 he was appointed a member of the Supreme Engineering Council and in 1915 became also under secretary of transport. He was president of the Railway Mission to the U.S.A. in 1917 and returned to Russia as under secretary of transport in 1919. From 1920 to 1923 he was high commissioner for railway orders.

Dr. Lomonossoff developed the method of testing steam locomotives now used by the U.S.S.R. and, with slight modifications, in other European countries. In 1920 his proposal to order a number of diesel locomotives was turned down by Trotsky, but in October 1922 the Soviet Cabinet authorized the construction of three. The first diesel locomotive designed by Dr. Lomonossoff was built in 1924 in Dusseldorf, Germany. In 1925 Dr. Lomonossoff went to England to place an order for the building of a 1,200-b.hp. Schelest diesel, but the locomotive was shipped to Russia in an unfinished state because, it is said, the Russian Government expressed doubts as to its usefulness.

A few years later Dr. Lomonossoff took up residence in England where he made many contributions to the Proceedings of the Institution of Mechanical Engineers, of which he had become a member in 1931. He received the degree of Dr. Ing. at the Technische Hochschule, Berlin, prior to settling in England.

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE JANUARY ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of Units	Horse-Power	Service	Builder
Illinois Terminal	4[1]	1,500		Electro-Motive
Union Pacific	8A[2]	2,250	Passenger	Electro-Motive
	14B[2]	2,250	Passenger	Electro-Motive
	10[2]	1,500	Road Switch	Electro-Motive
	22[2]	1,200	Yard switch	Electro-Motive

GAS-TURBINE ELECTRIC LOCOMOTIVE ORDERS

Road	No. of Locomotives	Horse-Power	Builder
Union Pacific	15[3]	4,500	General-Electric

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Canadian National	1,000	70-ton ore	National Steel Car
	200	50-ton refrigerator	National Steel Car
	150	70-ton covered hopper	National Stee. Car
	50	30-ton refrigerator	National Steel Car
	1,200	50-ton box	Can. Car & Fdry.
	150	30-ton flat	Can. Car & Fdry
	5	135-ton depressed center flat	Can. Car & Fdry.
	500	70-ton gondola	Eastern Car
	300	70-ton hopper	Eastern Car
	100	30-ton box	Eastern Car
	30	50-ton air dump	Eastern Car
	75	40-ton gondola	Marine Industries
Chicago Heights Terminal Transfer	25	50-ton box	American Car & Fdry
Gulf, Mobile & Ohio	100[3]	50-ton pulpwood	Company shops
New York, New Haven & Hartford	100[4]	Flat	Company shops
Reading	100[5]	50-ton pulpwood	Bethlehem Steel
St. Louis-San Francisco	100[6]	50-ton pulpwood	Company shops
St. Louis Southwestern	75[7]	70-ton gondola	Bethlehem Steel

PASSENGER-CAR ORDERS

Road	No. of cars	Type of car	Builder
Atlanta & West Point	1[8]	Passenger	Budd Co.
Canadian National	30	Baggage	National Steel Car
Chicago, Rock Island & Pacific	7	R. P. O.	Budd Co.
	5	Baggage	Budd Co.

[1] For April delivery.

[2] The diesel-electric locomotives are for 1953 delivery. Delivery of the gas-turbine locomotives is scheduled to begin early in 1954. Six units of the original order for 10 such locomotives have been delivered and the remaining four are scheduled for delivery next year. The 25 locomotives will involve an expenditure of over $14,000,000. Like their predecessors, each of the 15 additional gas-turbine locomotives will develop 4,500 hp. They will be about 83 ft. long and will pull a heavily loaded freight train at speeds up to 65 m.p.h.

[3] For delivery in second quarter of 1953.

[4] Estimated cost, $8,500 each. To be used in trailer-on-flat-car service. First cars expected to be completed this month.

[5] Cost estimated to be between $800,000 and $850,000. Delivery scheduled for September.

[6] Approximate cost, $780,000. Delivery expected during second quarter of this year.

[7] Estimated cost, $525,000. Delivery scheduled for July.

[8] Estimated cost, $142,000. Delivery scheduled for third quarter of this year.

NOTES:

Boston & Maine.—The B&M will carry out during 1953 and 1954 one of the largest modernization programs in its history with the purchase of 44 new diesel locomotives costing $5,000,000 and four stainless-steel sleeping cars at a cost of $200,000 per car. The new locomotives will, when delivered, bring the road's fleet to 277 and will permit the retirement of 83 steam locomotives, eliminating all steam locomotives on the system except some in service on suburban passenger trains. The new motive power, as planned, will consist of 14 800-hp., 14 660-hp., 5 1,200-hp. and 11 1,500-hp. units. The sleeping cars will have six roomettes, six sections, and four double bedrooms.

Great Northern.—Expenditures authorized by GN directors for 1953 cover more than $13½ million to be spent on diesel locomotives and other equipment, including 37 more diesel units, 500 box cars, 300 hopper ballast cars, 100 covered hopper cars, and 200 flat cars. In addition, the program for the subsidiary Western Fruit Express Company calls for the construction of 350 heavily insulated refrigerator cars.

Missouri-Illinois.—Directors have approved expenditures totaling $1,153,214 for improvements in 1953, including 100 70-ton hopper cars to be built at the De Soto, Mo., shops of the parent Missouri Pacific. The approved expenditures also cover purchase of two 1,500-hp. diesel units and eight miles of new 90-lb. rail.

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SUPPLY TRADE NOTES

AMERICAN LOCOMOTIVE COMPANY.—*Hunter Michaels* has been appointed vice president-operations, with direct responsibility for all plant operations. *D. W. Cameron* has been named vice-president-manufacturing, in charge of manufacturing operations at all plants.

◆

C & D BATTERIES, INC.—*Charles F. Weil* has been appointed regional manager, railroad sales, for the general Chicago district of C & D Batteries, not C & C Batteries as incorrectly reported in the January issue.

◆

PRESSED STEEL CAR COMPANY.—*W. W. Greenway* has been elected vice-president of the Pressed Steel Car Company, with headquarters at Los Angeles. He formerly was general manager of the Chicago steel tank division at Chicago.

◆

WESTINGHOUSE ELECTRIC CORPORATION.—The Westinghouse Electric Corporation will build a new plant for manufacture of welding electrodes and brazing alloys on a 52-acre site near Montevallo, 38 miles south of Birmingham, Ala. Construction is expected to start in February with the completion date set for September. The plant's principal product—welding electrodes—will supply all southern and Pacific Coast states; the brazing alloys will be shipped throughout the United States.

◆

GOULD-NATIONAL BATTERIES, INC.—The Industrial Division of Gould-National Batteries is soon to start production in a new $3,000,000 factory at Kankakee, Ill., which adds nearly five acres of floor space to the company's capacity for producing batteries needed by the military and by manufacturers and users of material handling trucks, diesel and other railroad equipment, mine locomotives, communications, etc. The plant combines factory and offices in a steel and concrete structure 522 ft. long and 302 ft. wide. There is also a one-story forming building, 196 ft. by 180 ft. The building is of solid masonry, with many individual rooms each completely acid-proofed and ample ventilated.

◆

BALDWIN-LIMA-HAMILTON CORPORATION.—*Paul T. Warner*, librarian of the Baldwin-Lima-Hamilton Corporation at Eddystone, Pa., retired recently, after 50 years of service with the company and its predecessors. As advertising manager of the Baldwin Locomotive Works, Mr. Warner was responsible for the first issue of its publication, Baldwin Locomotives, in July 1922. He was its editor until January 1933 and numerous articles on steam locomotives published in the magazine were written by him.

◆

E. I. DU PONT DE NEMOURS & CO.—*Alfred E. Pratt*, since 1933 Philadelphia regional transportation sales manager of the du Pont Finishes division, has retired after more than 26 years with the company. Mr. Pratt was in charge of sales of paints and other finishes in the railroad, aviation, marine, petroleum and steel industries. Sales in those fields in the Philadelphia area are now handled by *Robert M. Dean, Jr.*, regional industrial sales manager since 1947, assisted by *John D. Stokes*, who has been appointed district industrial sales manager.

◆

VAPOR HEATING CORPORATION.—*William C. Keeran*, has been appointed executive engineer. Mr. Keeran will supervise all phases of engineering, research, and design of the company's products. He will continue also as vice-president in charge of the Roth Manufacturing Company, Chicago, a wholly owned manufacturing subsidiary of Vapor.

W. C. Keeran

Mr. Keeran has been with Vapor eleven years with a background of engineering and production with other companies after receiving his Master's degree in engineering from Northwestern University.

◆

UNITED STATES STEEL CORPORATION.—The *United States Steel Company* has been merged into the United States Steel Corporation as part of a program to simplify the corporate structure of U. S. Steel. The corporation succeeds to all properties and rights of the subsidiary company, and all business formerly conducted by the U. S. Steel Company will be conducted in the name of the U. S. Steel Corporation.

The *United States Steel Supply division* of the corporation has appointed *John P. Connor* as district manager at Houston, Tex.

Mr. Conner attended the University of Alabama, began his business career in 1937 in the general sales office of U. S. Steel's Tennessee Coal & Iron division at Birmingham, and during World War II served as a captain in the Army Air Forces. He returned to the T. C. & I. as a sales representative at New Orleans in 1946, was transferred to Dallas in 1948, and from 1949 until his present appointment was a sales representative at Fort Worth.

◆

COLORADO FUEL & IRON CORP.—A wholly owned subsidiary of the Colorado Fuel & Iron Corp. has contracted to buy all the manufacturing business, plants and inventories of *John A. Roebling's Sons Company*, which will be operated as a subsidiary under the Roebling name.

A. F. Franz, president of the Colorado Corporation, has been named president of the Roebling subsidiary.

◆

MONTREAL LOCOMOTIVE WORKS.—*Perry T. Egbert* has been elected president of the Montreal Locomotive Works. *Duncan W. Fraser*, retiring president, will continue to serve as chairman of the board.

Mr. Egbert has been a director of Montreal Locomotive since 1950 and is also president of American Locomotive Company (page 102 January issue).

◆

GENERAL MOTORS CORPORATION, ELECTRO-MOTIVE DIVISION. *B. B. Brownell* has been appointed assistant chief engineer in charge of design and development; *D. S. Smilanich*, facilities engineer; *Bert Hefner*, electrical section engineer, and *L. L. Johnson*, senior project engineer of the *Electro-Motive Division* of General Motors. *L. M. Williams, J. S. Chisholm, T. O. Robertson* and *A. R. Walker* have been appointed factory branch managers reporting to the

SUMMARY OF MONTHLY HOT BOX REPORTS

	Foreign and system freight car mileage (total)	Cars set off between division terminals account hot boxes			Miles per hot box car set off between division terminals
		System	Foreign	Total	
July, 1950	2,745,932,894	....	....	23,957	114,619
August, 1950	2,937,455,020	7,422	15,490	22,912	128,206
Setpember, 1950	2,974,297,739	6,541	12,881	19,422	153,141
October, 1950	3,165,997,915	4,343	8,935	13,278	238,439
November, 1950	2,868,871,913	2,536	5,331	7,867	364,672
December, 1950	2,813,042,212	2,278	5,968	8,246	341,140
January, 1951	2,840,847,511	2,870	8,436	11,306	251,269
February, 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951	2,996,562,763	3,702	8,914	12,616	237,521
May, 1951	3,013,634,782	5,631	13,737	19,368	155,599
June, 1951	2,874,873,495	7,074	15,376	22,450	128,057
July, 1951	2,768,920,095	8,886	18,823	27,709	99,929
August, 1951	3,009,371,111	9,023	19,092	28,115	107,038
September, 1951	2,925,570,545	6,472	13,565	20,037	146,008
October, 1951	3,116,490,095	4,131	9,053	13,184	236,384
November, 1951	2,939,503,144	2,022	4,405	6,427	457,368
December, 1951	2,752,316,133	2,130	5,398	7,528	365,611
January, 1952	2,824,298,630	3,208	7,197	10,405	271,437
February, 1952	2,809,162,671	2,723	6,473	9,196	305,477
March, 1952	2,943,812,727	2,594	5,877	8,471	347,517
April, 1952	2,766,313,714	3,826	7,759	11,585	238,784
May, 1952	2,918,508,445	6,020	10,938	16,958	172,102
June, 1952	2,672,512,889	8,466	14,495	22,961	116,394
July, 1952	2,575,298,912	10,566	15,833	26,399	97,553
August, 1952	2,924,917,122	11,658	17,535	29,193	100,192
September, 1952	2,931,129,734	7,536	13,608	21,144	138,627
October, 1952	3,093,990,289	4,058	8,053	12,111	255,469

ALCOLID® installation...

A Align holes in lid with holes in box and insert square-headed retaining pin.

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B Push lid down to put spring under pressure and *withdraw shipping pin.*

C Close lid by pushing all the way down. Bend tab over head of retaining pin.

Installed in a matter of seconds, ALCOLIDS are specifically designed to overcome all the usual journal box lid troubles and to provide a lifetime of service.

Wear on the eyes of the hood is eliminated because the square-headed, locked retaining pin never rotates. This also prevents loss of lids and—coupled with the fact that a sturdy torsion spring seals the fully articulated cover tight—prevents lid vibration.

To put all these advantages to work for *you*, send for complete information to your ALCO sales representative in New York, Richmond, Cleveland, Chicago, St. Louis, St. Paul, San Francisco.

ALCOLID

PATENTED

RAILWAY STEEL-SPRING DIVISION

AMERICAN LOCOMOTIVE COMPANY

general manager. *George W. Elsey* fills the newly created position of manufacturing assistant to the general manager of the division. *J. E. Hacker*, assistant works manager, has been promoted to works

B. B. Brownell

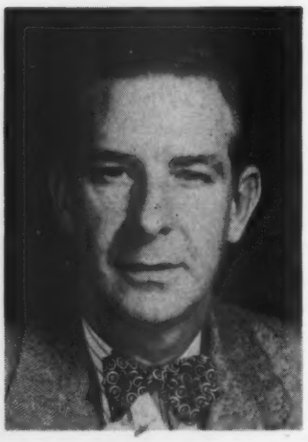
manager, and *E. A. Wondracheck*, repair plant manager, manufacturing manager, Plant No. 1 at LaGrange, Ill. *David R.*

D. S. Smilanich

Kendall becomes manufacturing manager of factory branches; *E. M. Imbur*, manufacturing manager of the Cleveland plant, and *Harry E. Schneider* manufacturing manager of Plant 2, Chicago. *Warren A. Thomas*, formerly sales manager of the LaGrange factory branch, is now manager of the rebuild section of the sales department of Electro-Motive.

Mr. Brownell is a graduate of Massachusetts Institute of Technology where he received an E.E. degree. He joined Delco Products Division of General Motors in 1935. He transferred to Electro-Motive in 1937 as a junior electrical engineer and was chief electrical engineer prior to his appointment as assistant chief engineer.

Mr. Smilanich received a mechanical engineering degree from Colorado State College. He became associated with Electro-



Bert Hefner

Motive Division in 1936 as a service instructor. He served in various engineering capacities, most recently being chief engineer of General Motors, Ltd., at London, Ont.

Mr. Hefner joined Electro-Motive Division in May 1941 as a mechanic. Later he worked as an instructor in the Service Department and most recently as a senior project engineer.

Mr. Williams started with Electro-Motive in 1938 as an engine tester. He successively moved to locomotive test, service engineer, parts and stores representative, sales representative, assistant rebuild sales manager and, most recently, rebuild sales manager in La Grange before his appointment as branch manager at Halethorpe, Md.

Mr. Chisholm was born in Pembena, N. D. and attended the University of North Dakota where he engaged in pre-legal studies. He joined Electro-Motive in April 1937 as a stock clerk. Since then he has worked as stockkeeper, zone parts manager, branch service representative, branch plant superintendent and branch plant sales manager.

Mr. Robertson joined Electro-Motive in June 1926. His activities with Electro-Motive includes service instructor, service engineer, district engineer, regional service manager at San Francisco and sales manager of the Emeryville Factory Branch.

Mr. Walker was formerly in the employ of the American Car & Foundry Company. He became associated with Electro-Motive as a field engineer in January 1946 following his service during World War II. He was district sales representative and regional service manager in the Chicago region before his assignment as branch sales manager for the factory branch at Jacksonville, Fla. His responsbilities as branch manager include both sales and manufacturing.

◆

WESTINGHOUSE AIR BRAKE COMPANY.—*H. W. Wolff*, vice-president of purchases of the Westinghouse Air Brake Company, has retired; *R. M. Hornbeck*, general purchasing agent, has succeeded Mr. Wolff, with the title of director of purchases.

◆

COPPERWELD STEEL COMPANY.—*J. Gordon Cavanagh* has been appointed sales engineer of the Copperweld Steel Company's Wire and Cable division, covering the lower peninsula of Michigan and all of Indiana. His headquarters will be in Detroit, as were those of his predecessor, *Donald T. Jones*, who is on leave of absence for service with the U. S. Navy.

◆

PAXTON-MITCHELL COMPANY.—Under a new sales policy Paxton-Mitchell sales organization has been augmented by 12 special railroad agents strategically located about the United States and Canada in or near key railroad centers. The company also has been appointed national distributor of Goodyear V belts for the railroad field.

Lewis sealtite car bolts

More than 85% of America's Class I railroads use Lewis Sealtite products. Designed to do a better job . . . to last longer . . . to meet the most exacting specifications. Specify Hot Dip Galvanized, Zinc finish for Double-Life and economy.

Lewis BOLT & NUT COMPANY
504 Malcolm Ave. S. E.
MINNEAPOLIS 14, MINNESOTA

LOOK FOR THIS STAMP OF U QUALITY

Sealtite bolts are available with Lokite Nut ∫2 (shown), or std. sq. and hex. nuts

Gulf Dieselmotive Oil

works 3 ways

to keep railway Diesels clean

1. **Effective detergent action fights piston ring belt deposits**

2. **High stability retards sludging**

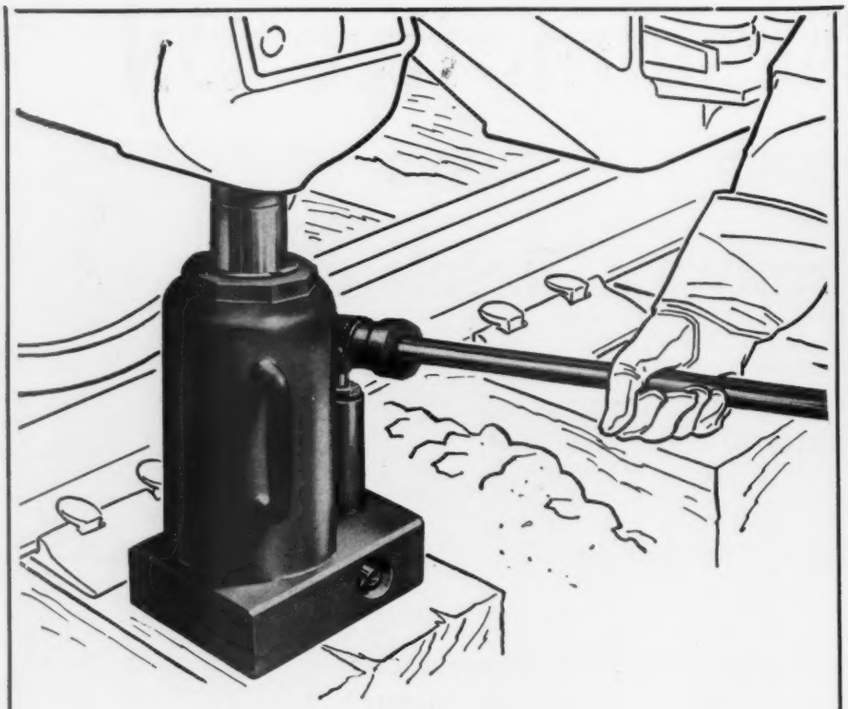
3. **Base stock quality and refining methods prevent hard deposits on piston crowns**

Gulf Dieselmotive Oil is ideal for railway Diesels. It protects against the accumulation of harmful deposits on compression and oil control rings, on piston crowns, and in ports. It cuts maintenance costs for engines with high power ratings, or for those which use fuels containing cracked materials or sulphur.

For further information on this quality oil, call in a Gulf Sales Engineer. Write, wire, or phone your nearest Gulf office.

GULF

Gulf Oil Corporation · Gulf Refining Company · Pittsburgh 30, Pa.



NEW! A 35 Ton Hydraulic Journal Jack

First in the Industry!

You asked for it and here it is—a brand new jack designed and built especially for servicing heavier freight cars. It can raise 35 tons 6 inches—is only 9.7 high—weighs but 55 pounds. With the 35H9.7, the job of inspecting and renewing journal brasses can now be done without the danger of overloading a lower capacity hydraulic journal jack—and the work can be done faster with less effort! If you have the problem of lifting heavy cars, we suggest you get complete details on this new 35 ton hydraulic journal jack immediately. Write the world's oldest and largest manufacturer of lifting jacks for bulletin AD29-G, The Duff-Norton Manufacturing Co., P. O. Box 1889, Pittsburgh 30, Pa. Canadian plant—Toronto 6, Ontario.

DUFF-NORTON

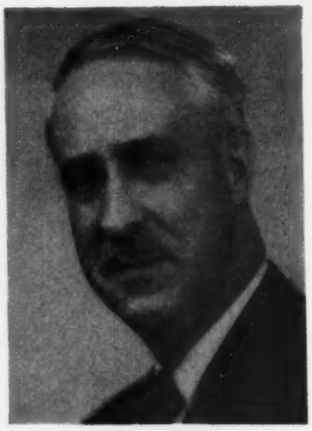
"Giving Industry A Lift Since 1883"

Jacks

GENERAL MOTORS CORPORATION.—The *Hyatt Bearings division* of General Motors Corporation has established a railroad sales

F. U. Naughton, Jr.

division at Harrison, N. J. *F. U. Naughton, Jr.*, formerly manager of eastern sales, has been appointed manager of railroad sales, reporting to J. R. Gilmartin, general sales



E. P. O'Neill

manager, and *E. P. O'Neill*, formerly a sales engineer with the eastern sales division, has been appointed manager of the eastern division.

◆

ARMCO STEEL CORPORATION.—*Logan T. Johnston*, formerly general manager of sales for the Armco Steel Corporation, has been elected vice-president in charge of sales, to succeed the late *John A. Ingwersen*. *Wallace B. Quail*, formerly manager of central area sales, has been appointed manager of the sales division.

◆

PHILIP CAREY MFG. COMPANY—*Dan Call* has been appointed railway sales manager, assisting the railroads in the Southeastern portion of the country with their special problems.

Mr. Call, an alumnus of the University of Virginia and Virginia Mechanics Institute, entered the railroad field with the Richmond, Fredericksburg & Potomac in 1929, serving in the capacities of draftsman, air-conditioning supervisor, mechanical inspector and general foreman of the locomotive department. He is a member of the Southern and Southeastern Railway Club.

In and Out of the Shops Quicker—

another advantage of WIX Engineered Filtration

•WIX Oil Filter Cartridges for Lubricating or Fuel Oil are available in filtrants best suited to the service performed, including the famous WIX interlapped cotton thread electronically controlled density construction.

WIX Railroad Filter Cartridges are engineered for your specific service . . . passenger, freight, switcher units or power units in maintenance of way equipment . . . and feature many exclusive advantages for high performance at low cost. These top quality WIX cotton thread Cartridges are built to withstand enormous pressures with no mechanical deflection . . . no slump or squash of filtrant . . . vibration-proof.

WIX metal center tube construction provides greater open area and is reinforced end to end with a heavy wire spring . . . positive end construction with built-in grip seal gaskets. Covered with one-piece heavy duty sock, expressly knitted to specifications. WIX Cartridges are easier to install and easier to remove. You, too, can keep Diesel engine performance UP and maintenance DOWN with WIX Engineered Filtration. Ask for further details.

REPRESENTATIVES

CAMPBELL A. BROWN, ATLANTA
W. M. GIBBS RY. SUPPLY CO., CHICAGO
SENECA TOOL CORP., NEW YORK
FRANK B. NUGENT CO., ST. PAUL
ST. LOUIS RY. SUPPLY CO., ST. LOUIS
ROY H. WEBER RY. APPLIANCES, SAN FRANCISCO

wix TRADE MARK REG.

ENGINEERED FILTRATION

RAILROAD OIL FILTERS

WIX ACCESSORIES CORP. • GASTONIA, N. C.

WIX ACCESSORIES CORP. LTD. • TORONTO, CANADA

WAREHOUSE STOCKS IN: GASTONIA • ATLANTA • ST. PAUL • CHICAGO • CLEVELAND • ST. LOUIS • OAKLAND

CHICAGO PNEUMATIC TOOL COMPANY.—The Houston, Tex., district sales office and service department of Chicago Pneumatic has been moved to larger quarters at 2120 Canada Dry street, Houston 23.

◆

ALBI MANUFACTURING COMPANY.—*C. A. Richardson*, for seven years A.A.R. chief engineer of Refrigerator Car Research, has been appointed exclusive representative and distributor to railroads, their subsidiaries, and associatedf industries for fire-retardent coatings made by the Albi company. Mr. Richardson will be located at 332 South Michigan Avenue, Chicago 4.

AMERICAN STEEL FOUNDRIES.—American Steel Foundries has formed a new Transportation Equipment Division, to effect a greater concentration of sales, manufacturing and development efforts for better service to railroad customers. Heading the new division is *C. L. Heater*, vice-president. All of the division's sales, including those to both railroad and private car companies, will be headed by *C. E. Grigsby*, vice-president. Mr. Grigsby, a graduate of the University of Michigan, has been with American Steel Foundries since 1923. Engineering, research and development work will be under the supervision of *R. B. Cottrell*, chief mechanical engineer. Mr. Cottrell, a graduate of the University of Kentucky, has been with the company

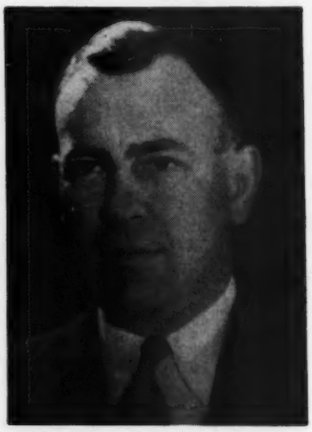
C. E. Grigsby

since 1914 and has served as chief mechanical engineer since 1942. *G. H. Snyder*, vice-president, will assist Mr. Heater in a staff capacity.

◆

NICKEL CADMIUM BATTERY CORPORATION.—*Albert H. Lindsay* has been appointed manager of the newly expanded service department, with offices at 100 Park avenue, N. Y.

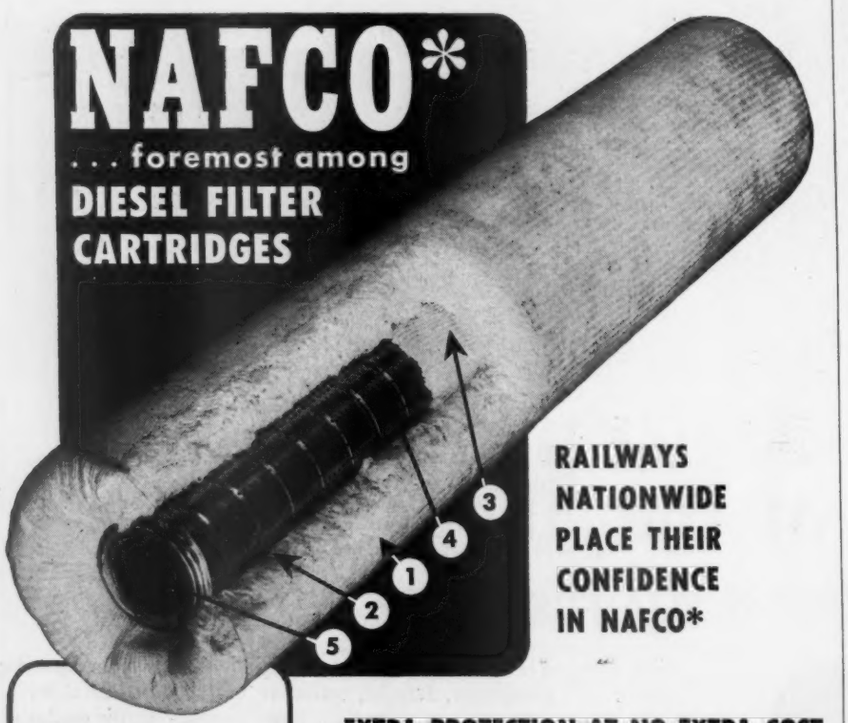
Mr. Lindsay became associated with Nickel Cadmium in January 1948 after 15 years as a service and sales engineer, with the Edison Storage Battery Division of Thomas E. Edison, Inc. As head of field service and test activities, Mr. Lindsay's duties will include dissemination of technical information pertaining to battery applications, engineering, maintenance and service instruction and overseeing the service of installed equipment.



Albert H. Lindsay

◆

SAFETY CAR HEATING & LIGHTING CO.—*Howard W. Keyser*, formerly assistant manager of the Philadelphia office of the Safety Car Heating & Lighting Co., has been appointed manager of the San Francisco office, and *H. K. Williams*, formerly sales representative at Chicago, has been appointed sales representative at Philadelphia. *W. P. Shotwell*, formerly manager of the San Francisco office, is now with the New Haven, Conn., plant.



Construction Features make the difference!

1. Tough, fine mesh cotton outer covering guards against cartridge damage.
2. Cotton thread waste, machine-packed to even density, equalizes filtering.
3. Heavy fine mesh tubing covering center tube acts as additional filtering agent.
4. Strong, reinforced steel center tube with free flow perforations for maximum efficiency.
5. Two-way gasket seals out oil by seating and squeezing action. Oil can't by-pass.

EXTRA PROTECTION AT NO EXTRA COST

Nafco Oil Filter Cartridges are used in diesel engines on the nation's leading railroads. Every cartridge is of uniform size and design, easy to install and remove. Guaranteed to meet all R. R. specifications, Nafco Cartridges are made of quality materials for longer, more dependable service performance. Specify Nafco and be sure of the best.

**Registered Trade-Mark of Nash Finch Co.*

FREE. Send for bulletin giving complete facts and cartridge reference chart.

REPRESENTED BY:

GRANDY RY. EQUIP. CO.
470 Union Commerce Bldg.
Cleveland 14, Ohio
TOwer 1-6500

CARRIERS SUPPLY CO.
818 Olive St.
St. Louis 1, Mo.
CHestnut 7016

KIRK-WIKLUND & CO.
1706 Baltimore Ave.
Kansas City 8, Mo.
BAltimore 1700

J. P. ARMSTRONG & G. H. PROFFITT
215 Market St.
San Francisco 5, Calif.
GArfield 1-3498

NASH FINCH CO.

1752 Hennepin Ave., Minneapolis 3, Minn., Lincoln 7611

Burlington's new Zephyrs roll on TIMKEN® bearings

YOU'LL never know Chicago and Kansas City are so close till you ride Burlington's new Kansas City and American Royal Zephyrs. With a short-cut route to shrink the miles and Timken® roller bearings to quicken its pace, it clips hours off the old running time.

By eliminating speed restrictions due to bearings, Timken bearings make high-speed streamliners like the Zephyr possible.

Timken bearings eliminate the "hot box" problem. Terminal inspection man-hours can be reduced 90%. Cost of lubricant cut up to 89%.

By cutting starting resistance 88%, Timken bearings insure jolt-free starts and smooth rides.

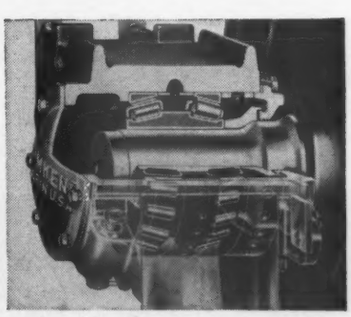
Made of the finest steel ever developed for railroad bearings—Timken fine alloy steel—Timken bearings are case-carburized to give them hard, wear-resistant surfaces and tough, shock-resistant cores. They take both radial and thrust loads in any combination. No extra thrust bearings are needed.

Over 6000 passenger cars, 7000 steam and diesel locomotives, 4000 freight cars and 3000 heavy industrial cars roll on Timken bearings today. No other bearing has so much to offer! No other bearing's so fully proved. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◎ AND THRUST →◎← LOADS OR ANY COMBINATION →✳←

Use Just 1 Cleaner for ALL your grease chasing jobs!

For Engine Pits... Diesel Engine Rooms... Trucks... Concrete Floors

Use Diesel Magnusol. Mixed with kerosene, diesel oil or safety solvent, it makes a cleaning solution that is sprayed on the surfaces to be cleaned. As it soaks in, it digs rapidly into the dirt, loosens the bond of the dirt with the surfaces being cleaned, and puts the dirt deposit in condition for rinsing away. After a soak-in period of a few minutes, you flush surfaces with water. The water forms an emulsion with the solution, which floats away all the dirt, leaving surfaces thoroughly clean, even in areas where hand work cannot reach. You don't have to heat Diesel Magnusol cleaning solution or the rinse water, although you can use a steam gun for flushing away.

Safe for Paint, Metals and Personnel

Diesel Magnusol makes a completely SAFE cleaning solution... non-flammable... non-toxic... fumeless... with no harmful action on human skin or on painted or varnished surfaces.

Put it to work for a Month!

Order a trial drum of Diesel Magnusol. Use it according to our directions for a month. If you are not completely satisfied, we will cancel the full invoice!

Railroad Division

MAGNUS CHEMICAL CO. • 77 South Ave., Garwood, N. J.

In Canada—Magnus Chemicals, Ltd., Montreal

MAGNUS CLEANERS AND CLEANING EQUIPMENT

Representatives in all principal cities

GUSTIN-BACON MANUFACTURING COMPANY.—*Herbert J. Smith* has been placed in charge of the new Gustin-Bacon Manufacturing Company offices recently opened in the Railway Exchange building, St.

H. J. Smith

Louis. Mr. Smith formerly was in charge of the company's railroad operations in Louisville, Ky. The new office will handle glass fiber insulation and other products which Gustin-Bacon supplies to the railroad industry.

◆

GENERAL ELECTRIC COMPANY.—*George T. Bevan* has been appointed manager of Alco-GE locomotive surveys in the G. E. Transportation department at Schenectady, N. Y. Mr. Bevan succeeds *Rudolph D. Krape*, who has retired. Mr. Bevan came to G.E. in 1941 from the Denver & Rio

George T. Bevan

Grande Western, where he did engineering studies for the chief engineer of research and testing.

A. F. Leach has been appointed manager of renewal parts sales for the G.E. welding department. *Arthur Ward*, a member of the welding department production group has been appointed manager of electrode sales, to succeed Mr. Leach.

◆

KOPPER COMPANY.—*Walter P. Arnold*, formerly vice-president and executive assistant to general manager of the Wood Preserving division of Koppers Company, has been appointed vice-president and general manager of the division to succeed

Pennsalt Cleaner #85

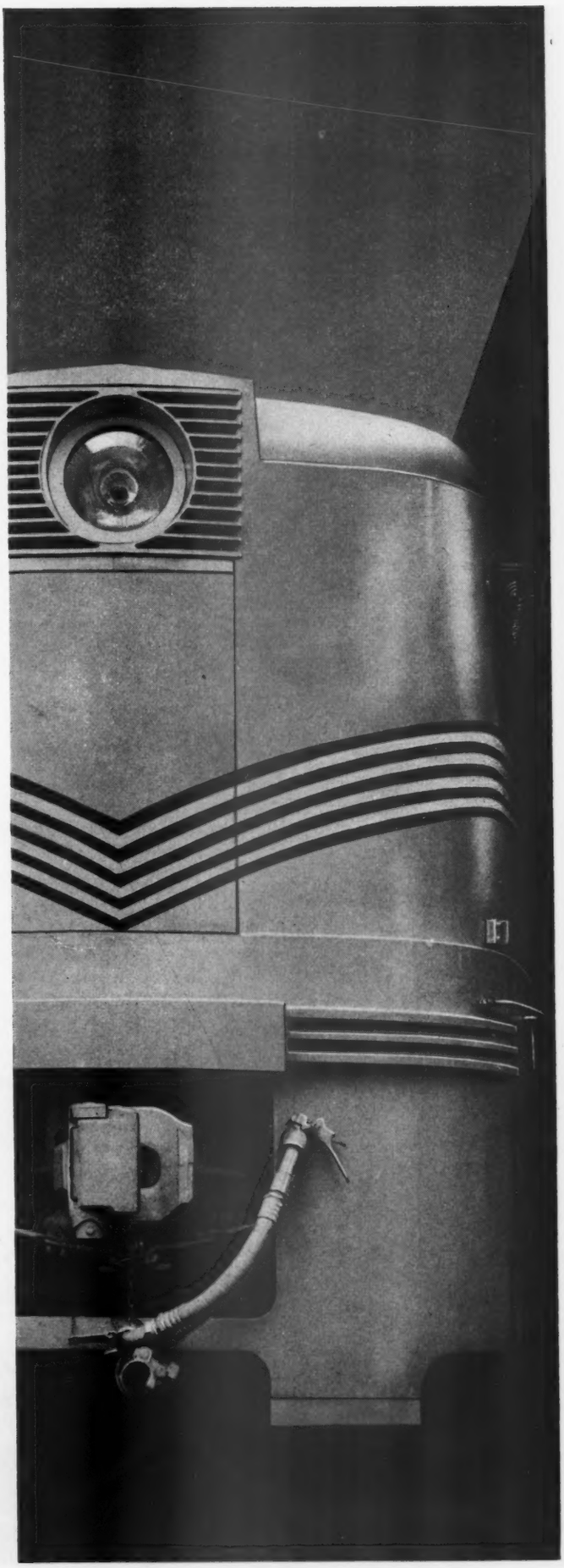
gets all the grime... leaves all the paint

In test after test, Pennsalt Cleaner 85 has amazed maintenance men because of its outstanding effectiveness and safety to paint at all normal use concentrations. It takes off soot, grease, insects, and road film with equal ease—rinses free and won't leave a streak. It is quickly soluble in hot or cold, hard or soft water. It can be used in car washing machines or it can be applied with bucket and brush.

And here's a point that's easy to take: Because of its "Controlled-Power" ingredients, Cleaner 85 is used at much lower concentrations than are ordinary cleaners. As a result, it actually costs substantially less to use this safer, more effective cleaner!

Will you let us prove these statements? Your nearby Pennsalt representative will gladly arrange a test on one of your own diesels—let you see a side by side comparison of your present cleaner's effectiveness against that of Cleaner 85. You be the judge. Call our man this week! Pennsylvania Salt Manufacturing Company, Maintenance Chemicals Department, EAST: 106 Widener Building, Philadelphia 7, Pa. WEST: Woolsey Building, 2168 Shattuck Avenue, Berkeley 4, Calif.

*Pennsalt also makes a complete line of back shop cleaners, descalers for steam generators, car cleaning compounds, and interior diesel cleaners. Your Pennsalt representative can give you detailed information about them.



Pennsalt Chemicals

CONTROLLED-POWER CLEANING BY PENNSALT

AIR-PUSH WINDSHIELD WIPERS
offer . . . INSTANT STARTING — MORE POWER FOR BIGGER WINDSHIELDS
— LOWER MAINTENANCE COSTS — ECONOMY OF AIR CONSUMPTION —
RUGGED CONSTRUCTION — COMPLETELY REPLACEABLE PARTS . . . .
that's why AIR-PUSH windshield wiper equipment is used on more than
85% of all diesel operated locomotives!
Send TODAY for complete details!
Sprague DEVICES, INC.
MICHIGAN CITY, INDIANA

Harry R. Condon, who has retired after 25 years of service.

Douglas Grymes, Jr., has been appointed manager of railroad sales. Mr. Grymes has been assistant manager of railroad sales for the past three years. As manager he

Douglas Grymes, Jr.

will have supervisory responsibility for sale to railroads of pressure-treated ties, lumber and timber pressure-treated.

Obituaries

J. M. P. McCRAVEN, manager of the railway traffic and sales departments of the Texas Company, died December 29, at the United Hospital, Port Chester, N. Y.

ROBERT J. WEBER, assistant district manager, Central sales district of the Westinghouse Electric Corporation, died on December 28.

JAMES L. YOUNG, 68, vice-president of the Schaefer Equipment Company, died at his home in Warren, Ohio, on December 5.

HENRY J. SANDBLADE, consulting engineer and vice-president of the Thomas Flexible Coupling Company died suddenly on January 5. Mr. Sandblade had been associated with the company at Warren, Pa., for the past 32 years.

PERSONAL MENTION

Bangor & Aroostook

W. J. STROUT, chief engineer and acting mechanical superintendent at Houlton, Me., appointed chief engineer and mechanical superintendent.

Bessmer & Lake Erie

ROBERT L. BAKER appointed assistant to superintendent motive power at Greenville, Pa.

Central Vermont

GORDON E. SPOONER appointed chief diesel inspector, with system jurisdiction over maintenance of diesel equipment and

for QUICK, CLEAN, UNIFORM HEAT at LOW OPERATING COST—

JOHNSTON SLOT-TYPE FORGING FURNACES

★ OIL OR GAS FIRED

★ SINGLE OR MULTIPLE SLOT TYPES

This furnace will maintain uniform neutral or reducing atmosphere for forging and welding which will avoid scale and decarburization. Construction features water, refractory or cast iron shields. Fire brick and insulating refractory brick lining with chrome refractory hearths are new features to reduce maintenance and operating costs and speed production.

★ BURNERS ★ BLOWERS ★ FURNACES ★ RIVET FORGES
★ FIRE LIGHTERS ★ TIRE HEATERS, ETC.

THE JOHNSTON LINE — DEPENDABILITY

JOHNSTON MANUFACTURING CO.
2825 EAST HENNEPIN AVE.
MINNEAPOLIS 13, MINN.

ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

ll diesel instruction activities.

Education: Vermont Electrical Engineering college.

Career: In employ of CV since 1922. A graduate of the Army's diesel locomotive

G. E. Spooner

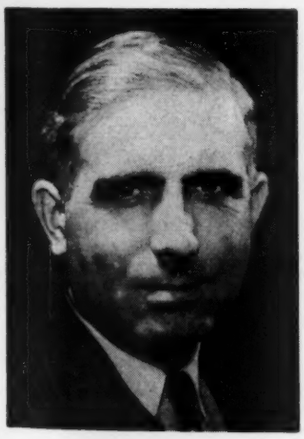
school. Served during World War II as a captain in the U. S. Army Transportation Corps in diesel railroad operational activities in France, Belgium and Germany. Served also in the Army during World War I.

Chesapeake & Ohio

D. F. DUNSMORE, assistant electrical engineer, appointed electrical engineer at Richmond, Va.

Born: January 10, 1901, at Hinton, W. Va.

Career: Began in 1917 as an electrician helper and lineman with the Hinton Water, Light & Supply Co. In 1921 became a



D. F. Dunsmore

partner in the Hinton Electric Company. Entered service of C&O in 1923 as road electrician and subsequently served as road lead electrician, road foreman electrician and road electric foreman. Appointed assistant electrical engineer at Richmond in 1946.

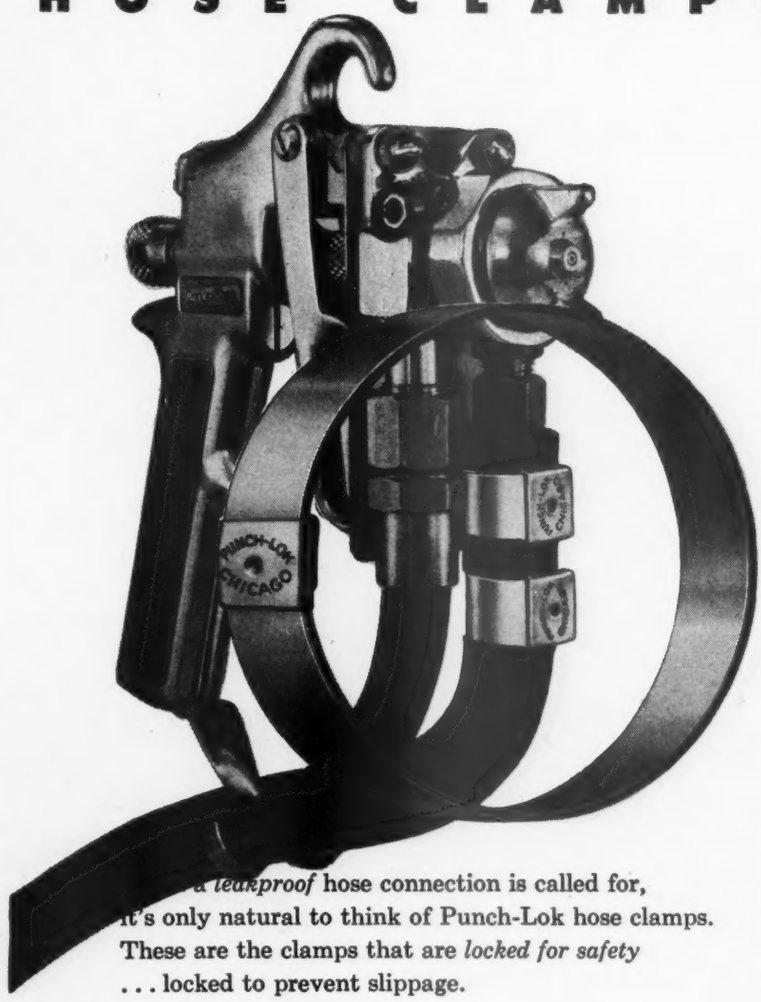
W. P. CHESNEY, electrical foreman, appointed electrical engineer, Pere Marquette district, with headquarters at Grand Rapids, Mich. as announced in January issue.

Career: Began with the PM in 1918 as a car lighting electrician at Bay City. In 1922 became associated with the Robert

naturally, AMERICAN Brake Shoe COMPANY chooses

PUNCH-LOK

HOSE CLAMPS



...a *leakproof* hose connection is called for, it's only natural to think of Punch-Lok hose clamps. These are the clamps that are *locked for safety* . . . locked to prevent slippage.

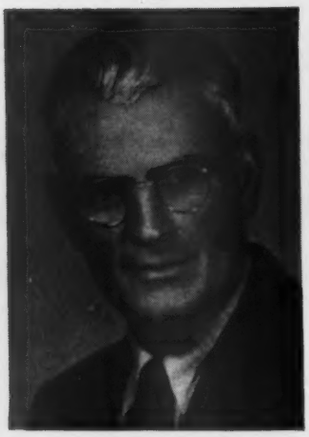
That is why the Kellogg Division of the American Brake Shoe Company chooses Punch-Lok hose clamps for its Kellogg-American steam spray guns.

In addition to applications such as this . . . Punch-Lok hose clamps are also used extensively for leakproof connections on air, water, and steam hose.

"The Sign of a Good Hose Clamp"

PUNCH-LOK *Company*

321 North Justine Street, Chicago 7, Illinois



W. P. Chesney

Gage Coal Company at St. Charles, Mich., but four years later returned to the PM as road electrician at Saginaw. In 1941 appointed electrical inspector and in 1944 electrical foreman at Grand Rapids.

Erie

CHARLES P. BROOKS, mechanical engineer at Cleveland, has retired.

Born: Shiloh, La., December 29, 1887.

Education: Graduate of Louisiana Polytechnic Institute (B. S. in M. E. 1910)

Career: Entered railroad service in May 1911 as a special apprentice on the Erie at Buffalo, and subsequently served as inspector of materials and tests at Meadville, apprentice instructor at Hornell, foreman at Port Jervis, test department assistant at Meadville, assistant engineer of tests at Meadville, supervisor of apprentices at Cleveland, and general roundhouse foreman at Marion. Appointed mechanical engineer in July 1940.

EARL D. HALL, engineer of tests and chief chemist in laboratory at Meadville, Pa., appointed mechanical engineer at Cleveland.

Career: Began his career with the Erie in 1913 as a boilermaker helper in the Meadville shops while attending college. Employed by the railroad continuously since 1925, when he became a special apprentice at Meadville. Subsequently was supervisor of road tests, train tonnage inspector, Wyoming division trainmaster, and dynamometer car operator. Appointed chemist at Meadville in 1933; to chief chemist in 1937, and engineer of tests and chief chemist in 1938.

New York Central.

ALBERT F. STIGLMEIER, general supervisor boilers and welding at New York, retired on January 1.

Born: Buffalo, December 12, 1886.

Education: International Correspondence Schools.

Career: Entered railway service as boilermaker apprentice on the Delaware, Lackawanna & Western at Buffalo in 1901. From 1905 until 1908 employed as journeyman boilermaker by Tashenberger Bros. Company Howard Bros. Boiler Works, Oldham Boiler Works and Barber Asphalt Paving

BETTER, FASTER, CHEAPER TESTING
for insulation and winding faults

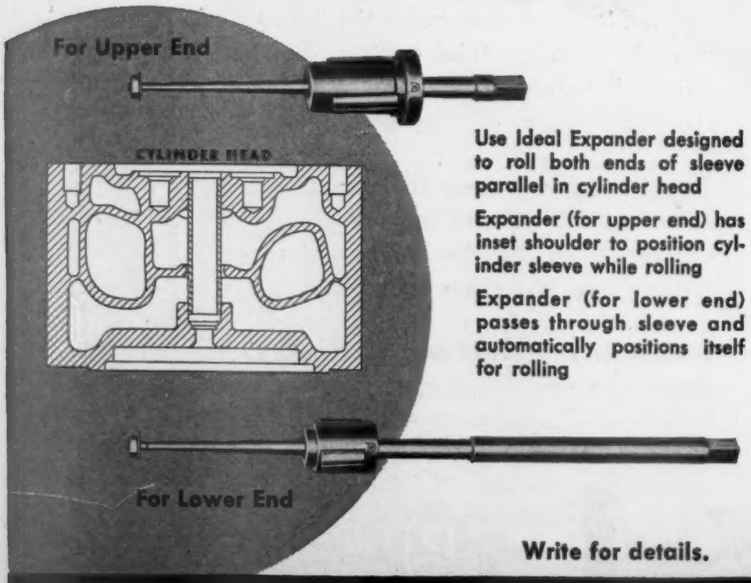
Westinghouse Surge Comparison Tester reduces production test time, permits positive results, fewer rejects—bringing substantial savings. This electronic device is designed to detect and locate insulation faults and winding dissymmetries in motors, generators, some types of transformers and coils. It operates quickly, simply, with fingertip control. Highly mobile and portable, it fits easily into production line techniques as well as repair shop. For more complete information, write Westinghouse Electric Corporation, I. E. Devices Section, 2519 Wilkens Avenue, Baltimore 3, Maryland.

YOU CAN BE SURE...IF IT'S Westinghouse

J-02257

IDEAL

For Rolling in DIESEL
Cylinder Head SLEEVES



Use Ideal Expander designed to roll both ends of sleeve parallel in cylinder head

Expander (for upper end) has inset shoulder to position cylinder sleeve while rolling

Expander (for lower end) passes through sleeve and automatically positions itself for rolling

Write for details.

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C

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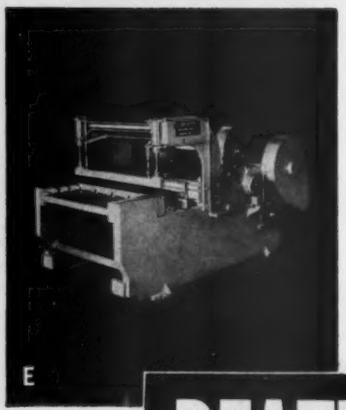
E

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A. BEATTY Co-Pun-Shear, one unit that does coping, punching and shearing without changing tools.

B. BEATTY Vertical Hydraulic Bulldozer for hot and cold pressing and forming of heavy metal.

C. BEATTY Heavy Duty Punch that handles steel up to 65 ft. long. Punches, webs, and flanges.

D. BEATTY Press Brake and Flanger handles any type of bending, forming, flanging, pressing.

E. BEATTY Horizontal Multiple Punch for line punching of vertical flanges.

Company, all at Buffalo; the NYC at Depew, N. Y., and the DI&W at Buffalo. Became layerout and flanger on the DI&W in 1908; assistant boiler foreman, Erie, at Hornell in March 1912, and general boiler department foreman of the Erie at Hornell, N. Y., in July 1912. Was assistant boiler department foreman of the NYC at West Albany locomotive shops from 1912 until 1917; general boiler department foreman at west Albany from 1917 until 1919; general boiler department foreman of the Baltimore & Ohio at Mt. Clare (Baltimore) locomotive shops from 1919 until 1923. Returned to the NYC in No-

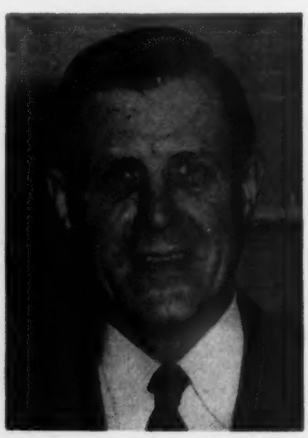
A. F. Stighmeier

vember 1923 as general boiler department foreman at West Albany, and in July 1941 appointed general supervisor boilers and welding for the system.

Associations: Chairman Executive Board of the Master Boiler Makers' Association in 1926; appointed secretary of the association in 1931, and secretary-treasurer in 1936, in which post he will continue. President of the West Albany Locomotive De partment Supervisors Club in 1939. Member of the American Welding Society.

Chicago & North Western

E. W. GEBHARDT, assistant superintendent car department, appointed superintendent of car department at Chicago, as noted in



E. W. Gebhardt

the November issue of the *Railway Mechanical and Electrical Engineer*.

Career: Began as a clerk in the piecework department of the C&NW car depart-

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GENERAL MOTORS LOCOMOTIVES

ment in 1917, and in 1921 became chief clerk. In 1926, after completing apprenticeship course, was a new equipment inspector at numerous freight and passenger-car-building plants. Appointed assistant car foreman at Chicago in 1927; foreman of the Chicago shop streamliner ramp in 1942; general car foreman at Chicago coach yard in 1944; district supervisor of car maintenance in 1945, and assistant superintendent car department in 1947.

E. F. IVERSON appointed district supervisor car maintenance of the Wisconsin (except Chicago terminal district), Madison, Dakota, Lake Shore, Ashland, and Peninsula divisions, headquarters, Chicago.

W. C. BARRER, superintendent car department, appointed assistant superintendent of car shops at Chicago.

C. P. NELSON, assistant superintendent of car shops, appointed general supervisor air conditioning at Chicago.

J. L. REED appointed master mechanic at St. Paul.

H. G. CRONNOBLE, master mechanic at St. Paul appointed master mechanic at Green Bay, Wis.

H. H. THOMAS, master mechanic at Green Bay, Wis., has retired.

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Chicago, Burlington & Quincy

CHARLES E. MELKER, superintendent motive power at Havelock, Neb., appointed general superintendent motive power of the C. B. & Q. and of the Colorado & Southern, with headquarters at Chicago. Position of superintendent motive power at Havelock abolished.

CLARENCE A. MOODY, superintendent of the locomotive shop of the CB&Q and superintendent motive power of the Colorado & Southern, at Denver appointed assistant general superintendent motive power of both roads, with headquarters at Denver. Position of superintendent of motive power at Denver abolished.

Southern

RICHARD E. FRANKLIN, master mechanic at Birmingham, Ala., appointed superintendent of maintenance equipment, with headquarters at Charlotte, N. C.

Born: December 3, 1919, at Birmingham.

Career: Entered employ of Southern on September 1, 1937, as a laborer and machinist helper in the shops at Birmingham,

R. E. Franklin

subsequently serving as a machinist apprentice, machinist, assistant erecting shop foreman, and erecting shop foreman. In April 1944 appointed general foreman at Danville, Ky.; spent two years in military service, and in February 1947 appointed general foreman at Ludlow, Ky. Appointed master mechanic at Meridian, Miss., in September 1950 and transferred to Birmingham in 1951.

PERSONAL MENTION—*Obituary*

CHARLES HENRY BILTY, retired chief mechanical officer of the Chicago, Milwaukee, St. Paul & Pacific, died recently in Milwaukee after a long illness.

Career: Began in 1894 as a machinist apprentice on the Milwaukee (then the Chicago, Milwaukee & St. Paul) at Milwaukee. Subsequently served as a machinist, draftsman and chief draftsman until 1910 when appointed mechanical engineer. In April 1918 appointed mechanical engineer for the northwestern region of the United States Railroad Administration. Returned to the CMSTP&P as chief mechanical engineer in 1920. Retired in 1943.